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WASEWITZ (H.). **Beiträge zur Biologie und Bekämpfung der durch Sclerotinia minor Jagg. verursachten Salatfäule.** [Contributions to the biology and control of the Lettuce rot caused by *Sclerotinia minor* Jagg.]—*Angew. Bot.*, xx, 1, pp. 70–118, 5 figs., 1938.

During 1936–7 the writer instituted an extensive series of investigations on the possibilities of controlling lettuce rot (*Sclerotinia minor*) in the Wiesbaden district of Germany [*R.A.M.*, xvi, p. 369], where the annual losses from this source amount to Rm. 50,000 to 70,000, corresponding to a yield reduction of 30 to 80 per cent., similar damage being also reported from Bavaria and Saxony.

In addition to lettuce, *S. minor* has been found attacking endives, radishes, carrots, asparagus, and beans [*Phaseolus vulgaris*], while in one case it was also detected on cauliflower. Both sound and wounded tissues may be invaded, either through the collar or by way of the basal leaves in close proximity to the soil. The fungus was further shown to be capable of developing and forming sclerotia on dead plant organs. Severe outbreaks of the rot are favoured by fluctuating spring temperatures, excessive atmospheric humidity, light soils (either acid or alkaline), greenhouse cultivation, and failure to observe a judicious order in crop rotation. Cultural control measures should be based on the avoidance of such adverse factors, supplemented by soil treatment either by chemicals or steam sterilization [full details of which are given] on the lines previously indicated. In a varietal reaction trial at the Giessen plant protection head-quarters the lettuce varieties Stuttgarter Dauerkopf, Maikönig (strains 2 and 3), Zichoriensalat, Wunder von Holland, Wunder von Stuttgart, Alter Frankfurter, and Ideal were slightly affected, Bohemie, Maikönig (strain 1), Trotzkopf, and Forellensalat moderately so, and seven other varieties were strongly susceptible.

Итоги научно-исследовательских работ Всесоюзного Института Защиты Растений за 1936 г. Часть I. Вредители и болезни зерновых культур и полезащитных полос. [Summary of the scientific research work of the Institute of Plant Protection for the year 1936. Part I. Pests and diseases of cereals and shelter belts.]—252 pp., 6 figs., 9 diags., 27 graphs, 4 maps, Издат. Всесоюз. Акад. с.-хоз. Наук им. В. И. Ленина. [Publ. Off. Pan-Sov. V. I. Lenin Acad. agric. Sci.], Leningrad, 1937.

This collection of papers by various authors on diseases of cereal

crops and shelter belts of trees contains the following items of interest.

P. A. PROYDA (pp. 72–76) in his report on the dry heat treatment of seeds of spring wheats for the control of loose smut [*Ustilago tritici*] points out that the mycelium of this fungus can be killed by temperatures of 52° to 53° C. before it becomes dormant some 10 days after the seed has fully matured, but withstands much higher temperatures later. Exposure for 7 minutes in air heated to a temperature of 52° reduced the infection from 3·7 and 4 per cent. in the control seed of different degrees of ripeness to 0·4 and 1·1 per cent. in treated seed and to 0·3 and 0·5 per cent. in seed previously heated for 4 hours at 28° to 32°. The same pre-heating and the same temperature and period of exposure applied in hot-water treatment reduced the infection to nil. The dry heat treatment decreased the percentage germination of the seed in proportion to the original germination ratio of the treated seed; treatment for one hour at 80° reduced the percentage germination of the spring wheat Novinka from 82 to 46 per cent. in the seed harvested after the wet season 1935 and from 98 to 80 or 90 per cent. in seeds harvested after the dry season 1936.

Several authors studied the effect of hydrogen sulphide on cereal seeds for the control of various smuts and bunt [*Tilletia caries* and *T. foetens*: ibid., xvi, p. 26]. V. I. LOBIK (pp. 76–78 and pp. 111–113) states that exposure for 72 hours in a concentration of hydrogen sulphide of 600 gm. per cu. m. killed the spores of *U. hordei*, *U. avenae*, and *U. panici-miliacei*. The treatment was found to injure the germination of the seed unless the seed was aired and dried for from 5 to 12 days after fumigation; a water content of over 17 per cent. allowed to persist in the treated grain inhibited germination altogether. Similar results were obtained by E. F. TOPEKKA (pp. 96–99) and Mme A. P. PETROVA (pp. 94–96).

Mme A. T. TROPOVA (pp. 81–84) studied the effect of air humidity and temperature on the infection of wheat with *U. tritici*. Artificial infection of seeds in 1935 at a temperature of 25° to 26° and an air humidity of 60 per cent. resulted, in 1936, in 46 per cent. diseased plants, and the raising of air humidity to 100 per cent. resulted in 84·1 per cent. diseased plants. The increase of temperature from between 13° to 14° to between 25° to 26° at an air humidity of 70° to 75° resulted correspondingly in 39 and 73 per cent. diseased plants.

S. S. SKVORTZOFF (pp. 87–89) suggests that the higher rate of respiration and the greater activity of the catalase in the wheat seed infected with *U. tritici*, which are apparent in the milky and waxy stages of maturity only, may serve as diagnostic factors.

V. K. GRUSHEVSKY (pp. 104–111) gives a description with diagrams and figures of the model of an apparatus for dry thermal disinfection of seed against loose smut [*U. tritici*] designed by N. I. Khodakovsky. In this machine the grain is heated to a temperature of 80° for one hour by gaseous products from the combustion of straw and wood, which are filtered and mixed with atmospheric air. It is suggested that the present stationary model should be changed into a portable type and that the present capacity of 1,000 kg. should be reduced to 250 or 500 kg., a size more suited to the needs of the average farm.

Mme S. P. ZYBINA (pp. 114–116) studied the virulence of different geographical populations of wheat bunt (*T. tritici*) [*T. caries*] [ibid., xvi, p. 27] and *T. levis* [*T. foetens*], inoculation tests being carried out on ten varieties of wheat in the laboratory and in the field. The results showed that *Triticum timopheevi* from western Georgia was immune from all collections of bunt except the strain collected on this host in 1936. *T. monococcum* from western Georgia was immune from all populations in the tests, but under natural conditions it is reported to be not entirely free from infection.

S. M. TUPENEVITCH (pp. 119–122) states that the harmful activity of *Fusarium nivale* [*Calonectria graminicola*: ibid., xv, p. 790], associated with 'snow mould' of winter-sown grain, begins in the early spring at temperatures from 4·3° to 22° and is favoured by high air humidity. Drainage, fertilization, and top-dressing of the fields in early spring are recommended as measures of control.

P. V. PAK (pp. 124–125) points out that high water content (over 18 per cent.) of cereal seed-grain favours the development of species of *Fusarium* [ibid., xv, p. 789] on the harvested grain during drying and storage; in seeds containing 8 to 14 per cent. moisture infection is diminished. Two to three years of storage is stated to reduce the infection in dry seeds to practically nil; heating the dry seed for 30 minutes at a temperature of 70° reduces the infection by about one-half.

S. V. VLADIMIRSKY (pp. 125–128) reports on the factors favouring the development of foot rot of wheat, due to *Helminthosporium sativum* [loc. cit.] in the Voronezh Region, which in some years may cause reductions in yield of from 5 to 9 per cent. Experiments with seeds artificially infected either by soaking in a spore suspension or by inoculation of the embryo through a wound showed that lack of moisture in the soil (30 per cent.) during the tillering stage considerably lowered the vitality of the plants and resulted in 5·3 per cent. leaf-spotting and 7·1 per cent. stem-browning, the corresponding figures for plants grown continuously at 60 per cent. soil moisture being 4·0 and 3·5. Shelter belts are considered to exert a good influence since the amount of infection of spring and winter wheats growing in soils situated near them and containing 22·5 to 36·2 per cent. moisture was 1·3 and 2·1 per cent., respectively, whereas in steppe soils [without shelter belts] containing 21·7 to 34·0 per cent. moisture infection amounted to 2·2 and 3·3 per cent., respectively. The spring wheat varieties Palestine, Tunis, Morocco, and the winter wheat type *ferrugineum* showed a fair degree of resistance to the disease in field tests.

M. V. GORLENKO (pp. 128–129) gives further data on the bacteriosis of wheat [*Bacterium translucens* var. *undulosum*: ibid., xvi, p. 243] in the Voronezh Region. The disease reduced the yield of the types *milturum* 0544, *lutescens* 1060/10, *ferrugineum* 085, *ferrugineum* 02, *caesium* 0111, and *milturum* 0321 by 31·1, 45·1, 38·1, 27·6, 55·4, and 42·8 per cent., respectively. The heights of diseased and healthy plants of *milturum* A–24131 were 66·7 and 68·4 cm., respectively, the corresponding figures for *caesium* 0111 being 58·2 and 63·6 cm. The length of ears and the number of spikelets in *caesium* 0111 were 6·2 cm. and 8·8, respectively, in the diseased against 7·7 cm. and 11·18 in the healthy plants, and in *milturum* 0544 9·4 cm. and 15·2 as against 9·6 cm. and

16·4. Evidence that the seed is the main source of infection was afforded by the fact that seed collected from diseased plants yielded almost 100 per cent. infected plants.

V. K. ZAZHURILO and M. V. GORLENKO (pp. 129–132) give a detailed description of the symptoms of wheat mosaic [ibid., xiv, p. 493], as observed in the Voronezh Region, which corresponds with the description of the yellow mosaic of wheat by McKinney [ibid., x, p. 646] and others [ibid., xvii, p. 379]. In field tests almost all varieties of winter wheats were susceptible to the disease, showing 5 to 34 per cent. of infection; most of the spring wheats, including the standard variety *caesium* 0111, showed no signs of infection.

V. K. BARTENEFF (pp. 134–136) describes the symptoms of black leaf spot [of unknown etiology] of sunflower [*Helianthus annuus*: ibid., xii, p. 571], which occurred rather extensively in the Voronezh Region in 1936, causing reductions in yield of 2·12 per cent. The disease spreads upwards in the plant forming transparent patches with black spots in them in the leaves, which eventually dry and fall off. Even a moderate intensity of infection reduces the size of the inflorescence and the number of seeds in each plant. Plant debris is one of the sources of infection. Autumn-sown plants showed in all field tests less infection than spring sown.

On pp. 137–145 several authors give a general survey of the work on cereal rusts [*Puccinia triticina* and *P. graminis*] for the year 1936 and furnish data on the distribution of rusts in the U.S.S.R. in general, and in East Siberia [ibid., xv, p. 348] and the Azoff–Black Sea Region in particular [ibid., xv, p. 785].

Mme V. BRYZGALOVA (pp. 146–148) announces the discovery of a new aecidial host of the brown wheat rust (*P. triticina*) in East Siberia. Artificial inoculation of the overwintered rosettes of *Isopyrum fumarioides* of the Ranunculaceae with teleutospores from *P. triticina* gave positive results in every case; artificial inoculation of wheat with aecidiospores from *Isopyrum* resulted in 73 per cent. infection in one test and 95 per cent. in a parallel test. The climatic conditions of the region are such as to permit the germination of the teleutospores in autumn in some years.

According to Mme N. I. PETRUSHEVA (pp. 148–150), the following physiological races of *P. triticina* were observed in 1936 in the Leningrad region: the most prevalent was race 20, followed in order by races 65, 13, and 70.

A. S. BARMENKOFF (pp. 150–152) [ibid., xvi, p. 163] sums up the results of research work in the U.S.S.R. on the physiological races of *P. triticina* from 1931 to 1936. Of the 25 different races so far observed, 20 and 65 are the most prevalent and have been observed before 1936 together with 9, 10, 13, 17, 19, 21, 24, 31, 53, 64, 66, 67, 68, and 69. Races 70 to 78, inclusive, are reported for the first time for the country.

Mme V. F. RASHEVSKAJA (pp. 152–154) [loc. cit.] states that wheat varieties belonging to *T. vulgare*, *T. compactum*, *T. spelta*, *T. sphaerococcum*, *T. dicoccum*, *T. persicum*, *T. macha*, and *T. dicoccoides* were all strongly susceptible to races 17, 20, and 65 of *P. triticina*; *T. monococcum* was resistant to the same races, and the barley variety Wiener was immune from all races of *P. triticina* and from the rye rust (*P. dispersa*).

Mme E. P. Goryatcheva (pp. 155–159) discusses the ecological characteristics of physiological races of *P. triticina* of different geographical origin. The optimum temperature for uredospore germination was almost the same (15° to 22°) for all the races tested (13, 17, 20, 65, and 68). Race 20 from different regions reacted differently at temperatures near the minimum (5° to 6°) and maximum (29° to 30°) for germination, whereas race 65 from different regions showed consistently the same reaction.

Mme V. Bryzgalova (pp. 166–167) [ibid., xv, p. 348] states that the minimum, optimum, and maximum temperatures for the spore germination of *P. triticina* in East Siberia are, respectively, 2° C., 5° to 8°, and over 20° for aecidiospores, 2°, 15° to 22°, and 26° for uredospores, and 2°, 9° to 14°, and 20° for teleutospores.

A. G. Marland (pp. 168–170) studied the influence of temperature on the development of *P. coronifera* [*P. lolii*: ibid., xv, p. 783] on oats. Aecidiospores and uredospores placed in drops of water on the leaf during the seedling stage germinated and the germ-tubes penetrated into the tissue within 5 hours at temperatures between 11° and 30° C., and after only 3 hours at 20° to 22·8°; complete infection leading to the later development of pustules took place after 5 to 6 hours at temperatures between 14° and 27°, but only after 10 hours and more at lower or higher temperatures. The incubation period of the disease resulting from inoculation with aecidiospores and uredospores varied little in the seedling and flowering stages under natural conditions; for seedlings it lasted 7 days at an average temperature of 19·3° and 14 days at 10·7°.

Mme L. L. Pronitsheva (pp. 175–178) gives some data on the control of wheat rusts (*P. triticina* and *P. graminis*) in the Azoff–Black Sea Region. It is stated that the aecidial stage of *P. triticina* has not been found on its aecidial host, *Thalictrum*, growing in this region and that the fungus perpetuates itself entirely on wheat. Autumn development takes place in August–September on volunteer plants, which become infected from the stubble and plant debris and are the main source of infection for the young winter wheat. Bad results are obtained when winter wheat is sown after winter or spring wheat, but not when spring wheat is sown after winter wheat, as the spring ploughing destroys the volunteer plants and the rust spores cannot overwinter on plant debris. Sowing between 15th and 20th September ensures the same yield as the earlier dates and lessens the incidence of both rusts. Vernalization decreases the incidence of both rusts in spring wheats only when combined with early dates of sowing. The resistance of wheat varieties to the physiological races of *P. triticina* found in the region (races 13, 17, 20, 65) was found to vary with the age of the plant. Only very few varieties (Fulhard, Kawvale, Kanred × Fulcaster 266287, Kanred × Fulcaster 266319, and Melanopus 069 from the Krasnodar Experiment Station) were resistant to the rust in the seedling stage.

Mme A. A. Shitikova-Roussakova (pp. 178–180) and I. M. Polyakoff (pp. 180–182) describe the results of tests with new fungicides for the control of wheat rusts. According to I. M. Polyakoff, the scorching property of Preparation No. 12 from the Institute of Plant Protection was successfully eliminated by the addition of oil. The improved

preparation now consists of 5 per cent. sodium silico-fluoride, 93 per cent. fine clay, and 3 per cent. thin lubricating oil. In dusting tests started on 22nd June, applications were made every 5 days at a rate of 30 kg. per hect. on stands of 30 sq. m., each divided into 10 plots. Dusting of the variety Durable with Preparation No. 12 applied at the beginning of the milk stage of maturity gave averages of 0·72 green leaves per plant and 27 pustules per leaf as compared with 0·70 and 84 in the controls and 0·75 and 50·3 in plants dusted with sulphur; the application of the same dust under the same conditions to variety *lutescens* 062 gave 0·71 green leaves and 9·3 pustules per leaf as compared with 0·75 and 22·4 in the controls and 0·76 and 16·6 in plants dusted with sulphur.

Mme R. I. Kikoina (pp. 182–185) sums up the effect of cultural measures on the development of wheat rusts in the Azoff–Black Sea Region [ibid., xv, p. 708]. Field plot tests showed that early dates of sowing (10th to 25th September) led to heavier incidence of *P. triticina* but gave better yields than later dates; in the case of *P. graminis* early dates of sowing resulted in a lesser degree of infection as well as better yields. Spring harrowing of winter wheats is also stated to exert a beneficial effect on the incidence of *P. triticina*.

D. V. Sokoloff (pp. 238–242) gives a few data on the control of diseases of trees in shelter belts. Collecting fruit bodies of *Polyporus squamosus* [ibid., xvi, p. 358], causing white stem and root rot of American maple [*Acer*] and elm, proved an effective and economical measure, one boy being able to cover in 4 hours 16 to 20 hect. in wide stretches with little undergrowth and 5 to 8 hect. in narrow stretches and young stands. In dusting experiments for the control of powdery mildew of oak, caused by *Microsphaera alphitoides* [*M. quercina*: ibid., xv, p. 63] the best results were obtained with sulphur-dusting at the rate of 40 to 60 kg. per hect. of a two-year-old oak stand, resulting in no diseased leaves against 22·7 per cent. in the control. It was observed that *Gloeosporium umbrinellum* [ibid., xv, p. 259] and *Septoria quercina* [ibid., vii, p. 428], causing brown leaf spots of oak, mostly attack leaves injured by *Phylloxera quercina*. Spraying with a 2 per cent. oil emulsion of copper naphthenate against the insect indirectly checked the disease, the percentage of diseased leaves being reduced from 19·7 in the untreated controls to 1·4 and 5·7 in two experimental plots.

Итоги научно-исследовательских работ Всесоюзного Института Защиты Растений за 1936 г. Часть II. Вредители и болезни технических и плодовых культур. [Summary of the scientific research work of the Institute of Plant Protection for the year 1936. Part II. Pests and diseases of industrial and fruit crops.]—pp. 255–444, 22 figs., 13 diags., 18 graphs, Издат. Всесоюз. Акад. с.-хоз. Наук им. В. И. Ленина. [Publ. Off. Pan-Sov. V. I. Lenin Acad. agric. Sci.], Leningrad, 1937.

This collection of papers by various authors on diseases of industrial and fruit crops contains the following items of interest.

Mme T. I. Fedotova (pp. 268–270) reports that the results of the serological analysis applied in wilt [*Fusarium buharicum* or *Verticillium dahliae*] resistance tests on 130 varieties of cotton [*R.A.M.*, xvii, p. 109] showed 80 per cent. agreement with the results of field experiments and

indicated the degree of wilt resistance not only in varieties, but even in pure lines within the limits of one variety.

Mme V. I. Shalyshkina (pp. 270–273) obtained some preliminary data on the length of the incubation period of the leaf form of cotton blackarm (*Bacterium malvacearum*) [ibid., xvi, p. 380] in relation to atmospheric temperature. The length of the period varied with the change of temperature from 4 days in August (average daily temperature 30° C.), to 5 days at the end of July–beginning of August (28°), 6 days in July (20° to 26°), 12 days in September (14°), and 17 days in October (12°).

Mme Fokina (pp. 273–274) describes her investigations into the pathological anatomy of cotton affected by *Bact. malvacearum* [ibid., xvi, p. 248]. Seeds partly immersed in a suspension of the organism so that the micropyle was covered showed a high percentage of infection at subsequent germination in soil, whereas no infection at all resulted when the chalazal end was submerged. Infection must therefore take place through the micropyle. The bacterial masses were found concentrated on tissues of the endosperm, situated directly under the micropyle, whence the infection passes to the cotyledons. It was observed that plants with high germination energy freed themselves quickly from the seed coat and adhering fragments of endosperm, and thus escaped infection. The apical bud can become infected through direct contact with the diseased cotyledons or with bacteria living on the inner surface of the seed coat, and the infection may cause the death of the whole germ, the destruction of the stem, or, if the degree of infection is slight, it may simply persist in the seedling. The growth of the petiole of the infected cotyledons and the formation of lateral buds are quicker than the spread of infection and therefore axillary buds can remain healthy. On entering the stem the organism becomes localized in the primary wood but eventually enters the secondary wood, leading to partial necrosis.

Mme A. V. Stepounnina (pp. 275–276) gives some information on the toxicity of meranin [ibid., xvi, p. 275] and furfurol to *Bact. malvacearum*. Exposure for 60 minutes to a 0·03 per cent. concentration of meranin (synthesized by L. G. Makorova) destroyed the bacteria but did not adversely affect the germination of the seed, and a similar result was obtained with furfurol.

G. T. Vyskvarko and V. I. Ulyanishtsheff (pp. 276–278) sum up the results of experiments with several new seed disinfectants against cotton blackarm (*Bact. malvacearum*) [ibid., xvi, p. 171]. Exposure for 10 minutes in 2 and 4 per cent. solutions of acid coal tar containing free sulphuric acid, ethers, and aromatic sulphonated acids produced 1·17 and 1·44 per cent. of stem infection, as compared with 2·24 per cent. in plants treated with 1:100 formalin, and with 17·72 per cent. in control plants. The effectiveness of formalin solutions was somewhat raised by the addition of 0·1 per cent. of sulphonated acids.

I. A. Meissakhovitch (pp. 285–288) reports on some further improvements in Heid's cereal seed-disinfecting apparatus [ibid., xvi, p. 249], leading to the construction of a new machine called Poum I, which can be used for cotton seed as well as for cereal grain.

K. I. KALASHNIKOFF (pp. 300–302) investigated the effect of temperature on the development of *Cercospora beticola* on beet [ibid., vii, p. 693; xvii, p. 367] under natural conditions. Up to the middle of September conidia of this fungus germinated in one day's time at the rate of 74 to 93 per cent.; later in the season the germination period extended to two days. The optimal temperature for the growth of mycelium appeared to lie between the average of 23·1° and the maximum of 35·9°; at lower temperatures the growth slowed down. Neither sporulation nor development of the disease, however, appeared to be dependent upon the temperature factor.

B. P. MATZULEVITCH (pp. 318–320) employed the serological method for identifying different forms of beet mosaic [ibid., xiii, p. 210; xvii, p. 428], such as marbled, speckled, and spot necrosis. The immunization of rabbits was achieved with antigens of all these viruses, previously purified with gelaluminium. The results of the experiment showed that all the tested types of mosaic of beet were caused by the same virus. The experiments appeared to confirm the work of Verplancke as to the possibility of transmission of infection through seed and sap.

A. M. SIGRIANSKI and Mme Z. N. OTPUSHTSHENNIKOVA (pp. 338–339) report on the combined occurrence of *Pseudopeziza trifolii* [ibid., xiv, p. 241], *Polythrincium* [*Dothidella*] *trifolii* [ibid., xv, p. 26], and *Ascochyta trifolii* [ibid., xi, p. 654] on red clover [*Trifolium pratense*], of which the first attacks the plant at the stage of tillering and incipient bud formation (3rd June), the second at the stage of bud formation proper (about 10 days later) and the third at the onset of flowering. The diseases were at their worst on 3rd July (average temperature 18·1°, average vapour pressure 11 mm.) when the incidence of infection amounted to 49·8 per cent.

The same authors (pp. 341–342) give a list in tabular form of micro-organisms found on seeds of red clover of local and Czechoslovakian origin and the percentages of infection caused. The list comprises *Botrytis anthophila* [ibid., xiii, p. 390], *Fusarium* spp.; bacteria, *Alternaria tenuis* [ibid., x, p. 425], *Cladosporium* spp. and *Penicillium* spp. *A. tenuis* does not appear to be responsible for browning of the seed coat and the low germinability of seeds, since it was not observed on the Czechoslovakian seeds, which showed 24 per cent. of browning. All the above-mentioned pathogens are fairly resistant to seed treatment with formalin or mercuric chloride, but exposures for 5 minutes to a 0·5 per cent. concentration of mercurized aniline was detrimental to all of them.

A. M. SIGRIANSKI and Mme O. M. MINYAEVA (pp. 339–341) describe the results of their study of *B. anthophila* on red clover. Single hyphae or a clump of mycelium of this fungus can be easily detected in sections of the seed, concentrating mostly in the small cavity near the embryo, or sometimes round or within the embryo. Preliminary germination experiments showed that infection of the seeds does not always lead to the infection of the seedlings. Within the diseased plant the fungus penetrates roots, stem, petioles, and all parts of the flower, but sporulates only on the anthers and sometimes in the gynoecium. The presence of the fungus in the ovary does not inhibit the production of seed, and the output of infected seeds is therefore very high. The secondary infection is carried by all flower-visiting insects, especially by *Apion*,

and possibly by wind from overwintered diseased plants of the cultivated and wild red clovers. The formation of mycelium was observed on the petals on the 5th day after inoculation, in the style on the 10th day, and in the ovary on the 15th day. The mycological analysis of 560 flowers showed 13 diseased and 11 healthy among the light-coloured, 5 diseased and 1 healthy among the 6 bright-coloured, and 42 diseased and 488 healthy among the 530 normally-coloured flowers.

A. M. Sigrianski and Mme T. J. Potapova (pp. 342–344) describe some of the results of series of experiments begun on anthracnose (*Gloeosporium caulivorum*) [*Kabatiella caulivora*: ibid., xvi, p. 754] of red clover. The organism appeared to develop best on agar media containing glucose and ammonium nitrate, and on liquid media. Hot and dry weather in the summer of 1936 arrested the spread of the disease, which developed fully only from September, at an average temperature of 9° to 16·2° and an average relative humidity of 79 to 85 per cent., till the onset of snowy weather. Artificial inoculation of the flower, the upper part of the peduncle, the stem, and the bracts of the first, second, and third internodes with or without puncturing of the epidermis produced the symptoms of the disease in the form of brownish patches, and the formation of conidia took place after 10 to 15 days, 5 to 10 days, 5 to 10 days, and over 10 days, respectively. The lower part of the stem showed no infection.

Mme N. Zelenova (pp. 351–355) discusses the results of comparative applications of the serological method and of field tests in determining the resistance of flax varieties to *Melampsora lini* [ibid., xvii, p. 323] and *Fusarium lini* [ibid., xvii, p. 396], which showed an agreement of 83 per cent. in the case of the first fungus and almost complete agreement in that of the second.

Mme A. A. Ovtshinnikova (pp. 376–378) reports on the occurrence of *Monilia* [*Sclerotinia*] *fructigena* and *M.* [*S.*] *laxa* [ibid., xvi, p. 190] on pome fruits in the Krasnodar region. *S. fructigena* attacked mostly fruit and fruit branches, whereas *S. laxa* was found causing blossom blight, branch and shoot necrosis, and fruit rot on apples and pears; the fungus entered the plant when still in the flowering stage, mostly through injuries inflicted by *Rhynchites bacchus*, *Tinetocera*, *Cocoecia*, and *Pandemis*. It was observed during the year that, on pear trees, *S. fructigena* developed almost without exception in wounds or cracks caused by *Fusicladium pirinum* [*Venturia pirina*].

F. E. Poushin (pp. 429–434) describes a new motor-sprayer for large fruit orchards. The apparatus [of which two illustrations and one diagram are given] consists of two pairs of vertical pipes fitted with lateral spray nozzles and suspended from a high framework on either side of the machine. The two pairs of pipes fit over the trees on each side as the machine passes between the rows.

Pole Evans (I. B.). **Survey of a year's research work. Annual Report of the Division of Plant Industry.**—*Fmg S. Afr.*, xii, 141, pp. 528–547, 14 figs., 1937.

Among the numerous items of phytopathological interest in this report [cf. *R.A.M.*, xvi, p. 367] the following may be mentioned. In connexion with an inquiry into the etiology of November drop of

oranges in the Kat River Valley, *Alternaria citri* [ibid., xvii, p. 310] was found to occur almost as frequently in normal green fruits as in dropped ones. Of 40,000 dropped fruits collected in a block of 1,000 trees, 17 per cent. were infected by navel-end rot.

Of 652,820 citrus trees inspected in the eastern Cape Province, 909 were affected by psorosis, while only 26 diseased specimens were detected among a total of over 107,000 examined in the western areas.

'Kromnek' [believed to be identical with spotted wilt: loc. cit.] of tomatoes was reported to be causing heavy damage at Port Elizabeth, where it was previously unknown. A closely similar disease has been observed attacking up to 50 per cent. of the petunia plantings near Pretoria. The virus of tomato bunchy top was found to be transmissible through the seed to seedlings of *Solanum ircanum*, as well as to *Datura stramonium*, the latter showing no visible reaction and acting as a carrier. Both the tomato and tobacco crops suffered extensively from mosaic, especially in the Rustenburg area of the Transvaal; the disease is probably responsible for a serious depreciation of quality (spotting and burning) as well as quantity in the foliage of affected tobacco plants. The sugar-cane varieties Co. 281 and 301, now widely grown in Natal, have proved to be highly resistant to streak.

All the rusted wheat samples so far examined in the summer rainfall area have yielded physiologic race 34 of *Puccinia graminis*, to which only 4 out of 106 South African wheats were found to be resistant, while 8 reputedly resistant varieties from Kenya and 4 from Canada also succumbed to infection. Inoculation experiments with the rust further gave positive results on 75 cross-bred wheats from Potchefstroom.

In inoculation tests on maize with *Gibberella saubinetii* and *Diplodia zeae*, ear infection occurred at any time during growth, invasion taking place either through the silks or directly through the leaves of the sheath. Wounds are necessary for infection by *Fusarium moniliforme* [*G. moniliformis*] and *F. moniliforme* [*G. fujikuroi*] var. *subglutinans*.

Exceptionally severe outbreaks of *Cercospora* [*personata*] and *Sclerotium* [*rolfsii*] caused serious damage to the Springbok Flats and northern Transvaal groundnut crops.

A *Fusarium* wilt of sann hemp [*Crotalaria juncea*: cf. ibid., xvii, p. 40, and below, p. 445] was reported from Brits and the Kat River Valley, where the crop is used for cover purposes in citrus orchards.

An outbreak of potato blight (*Phytophthora infestans*) occurred in the northern Transvaal, a rare event in South Africa.

Details are given of the work in progress at the Low Temperature Research Laboratory, Cape Town, in connexion with storage of various fruits and eggs [see below, p. 469].

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, xlix, 2, pp. 67–72, 7 figs., 1938.

Investigations are stated to have shown that a considerable part of the extensive wastage which in 1936 occurred in Ohanez export grapes in the form of internal breakdown, fruit and stalk rots caused by various [unspecified] fungi, and fruit shedding [*R.A.M.*, xv, p. 482] was chiefly attributable to careless handling of the grapes during

harvest, inadequate packing, and the lack of the necessary precautions before and during cold storage. The solution of the wastage problem lies in the growers, packers, and exporters paying close attention to these points.

A brief description [with diagram] is given of a type of 'spike harrow' [ibid., xiv, p. 460] which is said to be gaining favour for soil sterilization by steam in tomato glasshouses in Sydney.

Notes are given on three virus diseases of dahlia recorded in New South Wales, namely, mosaic [ibid., xiv, p. 634], stunt [ibid., xii, p. 697], and [tomato] spotted wilt [ibid., xv, p. 280; xvi, p. 285].

Laboratory and greenhouse studies of the causes of the defective germination of pea seeds, which during the few past seasons has been experienced by pea-growers in different parts of the State, resulting in thin stands or complete failures, showed that defective seed lots harbour certain fungi which apparently establish themselves in seeds injured during or subsequent to harvesting but are not carried in normal seeds, and which under favourable conditions may inhibit germination or bring about the partial or complete destruction of the seedlings [cf. ibid., xvii, p. 431].

Eleventh Annual Report of the Commonwealth Council for Scientific and Industrial Research for the year ended 30th June, 1937.— 89 pp., 1937. [Received March, 1938.]

In this report [cf. *R.A.M.*, xvi, p. 233] it is stated that a survey made in Australia of the incidence and relative importance of the diseases causing apple 'die-back' and 'sour sap' [ibid., vii, p. 791; ix, p. 434] showed that fungal root rots, e.g., *Armillaria mellea*, wound parasites, e.g., *Polystictus versicolor*, malnutrition, and loss of surface soil by erosion are all causative factors, which, however, vary in importance in different localities, and individually are seldom the most frequent cause in any district. The most important and widely prevalent form of apple die-back is that known as 'pruning die-back' in Western Australia and 'rosette' or 'little leaf' in Queensland and South Australia; this disease, the cause of which has not yet been ascertained, occurs in all areas north of latitude 36° S., becomes severe north of latitude 35° S., and appears to become worse the farther north one goes.

Pre-storage exposure for 36 hours to atmospheres containing 50 per cent. of carbon dioxide induced brown heart [ibid., xvi, p. 233] in Sturmer Pippin and French Crab apples, but not in Cox's Orange Pippin, Scarlet Pearmain, or Jonathan. Increase in the concentration of respired carbon dioxide in the storage chamber appears to increase liability to brown heart, induce Jonathan spot [ibid., xvi, p. 107] in mature fruits, and reduce late scald in Sturmer Pippin apples. Severe brown heart of pears [see below, p. 468] developed after 8 weeks' storage in atmospheres containing over 10 per cent. carbon dioxide.

In breeding for resistance to flag smut [*Urocystis tritici*: ibid., xvii, p. 228] it was found that the selection of individual plants for freedom from infection is useless, at least in the early hybrid generations, but selection based on progeny tests is effective.

The viruses causing destructive diseases in 17 potato varieties in Victoria were nearly all of the Y type. X type viruses occurred in a

latent or semi-latent form in all samples of the common commercial varieties examined from Victoria, New South Wales, Tasmania, and Western Australia. So far three groups of latent potato viruses have been distinguished, viz., the X type (including ring spot, mottle, and yellow mottle), B, and F.

Extensive grafting experiments gave no evidence that needle-fusion of pine trees [ibid., xvii, p. 149] is infectious. Susceptibility greatly declines three to eight years (according to the species) after the trees are planted out.

The British Food Investigation Board and the Citrus Preservation Technical Committee have agreed on the following classification of non-parasitic disorders of stored citrus fruits: (1) storage spot (*a*) button lesions, (*b*) lateral lesions [ibid., xvi, p. 233], (2) scald, (3) gooseflesh, (4) flavocellosis, and (5) glazed scab. Non-parasitic rind disorders seem generally to form the chief hindrance to the successful export of Valencia oranges. *Penicillium italicum* is stated to be comparatively unimportant on oranges, moulding generally being due to *P. digitatum*; *Phomopsis* [*Diaporthe*] *citri* is responsible for an appreciable amount of wastage in oranges from the coast of New South Wales.

In processing experiments with various materials in solution used against moulds on oranges borax invariably gave almost perfect control, even on fruits inoculated experimentally with *P. digitatum*, no other material tested giving comparable results. Recontamination of the fruit after treatment, however, results in wastage. When wounded, inoculated, and unwounded Washington Navel oranges were intermittently fumigated over a period of 7 weeks at 70° F. with nitrogen trichloride gas [ibid., xv, p. 576], controls being held without gas for a similar period, the treatment reduced wastage in the wounded and unwounded fruits by 76·2 and 58·5 per cent., respectively, but had no effect whatever on the inoculated fruits, which were completely wasty after six weeks' storage. The use of nitrogen trichloride for the immediate gassing of fruit on its reception at the packing shed should prove beneficial to the fruit and also, indirectly, in shed disinfection. The gas is, however, a dangerous explosive, and there is no likelihood of its immediate commercial release in Australia.

Valencia late oranges stored at 40° are susceptible to storage spot in the pre-climacteric stage, and for about three weeks after the climacteric. Control results from storage for 3 weeks at 50° before storing at 40°, or from delayed picking.

Su (M. T.). **Report of the Mycologist, Burma, Mandalay, for the year ended the 31st March, 1937.**—9 pp., 1937. [Received April, 1938].

The following are among the items of interest in this report [cf. *R.A.M.*, xvi, p. 154]. A fungus resembling *Helminthosporium* was isolated from the grains of XKF 7–81 rice plants with dark brown glumes and inoculated into the flowers of the same strain and XeF 7–53, producing discolorations on 96 per cent. of the grains in both, compared with an incidence of 6 per cent. in the uninfected controls, the symptoms on the latter strain being particularly reminiscent of those observed in nature.

Ustilaginoidea virens, the agent of false smut of rice [ibid., xvi, p. 231],

caused little damage at Hwambi during the period under review, in contrast to its high incidence in the previous year. In Quaker oats agar cultures the smut failed to grow at and above 34° C., whereas at 32·5° and 23·25° it grew 23 and 67·5 mm., respectively, within 46 days. The sclerotia of *U. virens*, after one year buried in the soil, were found to be reduced to a dark green, powdery mass of non-viable spores.

Considerable damage was caused at Madayo by the black stem disease of betel vines (*Piper betle*), associated with a species of *Gloeosporium*.

Diplodia natalensis was found to be the chief agent of decay in stored mangosteens (*Garcinia mangostana*) [ibid., xvi, p. 154], infection (53 and 25 per cent. in the pulp and stalks, respectively) probably taking place after plucking. *Phomopsis* sp. caused 28 and 14 per cent. pulp and stalk infection, respectively, while *Fusarium*, *Pestalozzia*, and *Gloeosporium* spp. were practically confined to the stalks. Fruits stored at 35° to 50° F. kept better than those held at 81° to 89°; a 1·5 per cent. formalin dip (15 minutes) checked decay at the latter but not at the former temperature, at which 30 minutes' immersion in 8 per cent. borax or wrapping in iodized paper were more successful.

A species of *Gloeosporium* with much larger spores than those of *G. ampelophagum* [*Elsinoe ampelina*] severely attacked vines in Mandalay and Kyauksè District, producing sunken spots on the twigs and eventually killing them. Good control was obtained by the excision of diseased material, followed by treatment with 1 per cent. Bordeaux mixture.

Sann hemp (*Crotalaria juncea*) at Pyinmana suffered appreciable damage from a *Fusarium* wilt [see above, p. 442].

Forty-ninth Annual Report of the Rhode Island State College Agricultural Experiment Station.—44 pp., 1937. [Received April, 1938.]

The following items of phytopathological interest occur in this report [cf. *R.A.M.*, xv, p. 705]. The damage frequently inflicted on tomato foliage by chemical sprays [ibid., xvi, p. 714] is generally intensified when environmental conditions are such that a protracted period is necessary for the liquid to dry, while insufficient available soil moisture is another important contributory factor. No differences in the stomatal behaviour of sprayed and unsprayed Ultropak tomato leaves could be discerned in trials with copper fungicides, and it is thought that the influence of spray films on transpiration may to some extent be explained by the permeability of the epidermis, which was shown by microchemical tests to be composed of undifferentiated cellulose.

The best control of apple scab [*Venturia inaequalis*] on the Baldwin, McIntosh, Rhode Island Greening, and Northern Spy varieties was given by an entire schedule of 1 in 40 lime-sulphur, which reduced the incidence of infection on the two first-named varieties from 22·74 and 53·23 to 1·81 and 3·12 per cent., respectively. Flotation sulphur paste (1 in 80) produced larger and brighter green leaves than the other treatments, but its relatively low toxicity to the scab fungus and tendency to cause russeting preclude its exclusive use.

Dusting spinach seed with copper oxide [against unspecified fungi: *R.A.M.*, xvii, p. 219] consistently increased the yield by from 34 to 100

per cent. in both spring and autumn crops; the same treatment also benefited beet, cucumber, and tomato seeds. The treatment of planting soil with formaldehyde or trioxymethylene dusts gave good results in the case of spinach, beet, cucumber, tomato, and peppers [*Capsicum annuum*].

All the mercury compounds, both organic and inorganic, that have been placed on the market for the control of brown patch [? *Corticium solani*: ibid., xii, p. 450; xvi, p. 468] and dollar spot [ibid., xv, p. 706; xvi, p. 681] of turf proved equally effective at 68° F. The same treatments may be recommended for the elimination of pink patch (*C. fuciforme*) [ibid., xvi, p. 468], the temperature range of which was found to lie between 8° and 30° C., with an optimum at 18° to 20°.

Fifty-fifth Annual Report of the Ohio Agricultural Experiment Station 1935–1936.—*Bull. Ohio agric. Exp. Sta.* 579, 139 pp., 12 figs., 3 graphs, 1937. [Received April, 1938.]

In the section of this report dealing with botany and plant pathology (pp. 34–42) [cf. *R.A.M.*, xvi, p. 440] H. C. Young states that the 1936 season was very unfavourable for the development of apple scab [*Venturia inaequalis*] in Ohio. Infection occurred only in the late delayed dormant stage, and was easily controlled with a 1 in 50 lime-sulphur spray, though wettable sulphur sprays and lime-sulphur 1 in 60 did not give complete control. Applications to be effective had to be made about 36 hours after infection had started, even with lime-sulphur 1 in 50. The results show that a slightly stronger mixture than that ordinarily used is necessary when rainy weather interferes with the exact timing of early sprays.

Young and H. F. Winter found that the adhesiveness of sulphur mixtures depends to a considerable extent on the amount of wetting agent used and that the addition to wettable sulphurs of very small quantities of colloidal materials such as gelatine or skim milk allows a great reduction in the amount of wetting agent required. The following formulae were satisfactory combinations: (1) aresklene [ibid., xvi, p. 196] 0·1 oz., gelatine 0·2 oz., and sulphur 5 lb.; (2) Grasselli wetting agent 2A 0·1 oz., gelatine 0·2 oz., and sulphur 5 lb.; (3) dry lime-sulphur 1 lb., and sulphur 4 lb.

Germination tests with the conidia of *Glomerella cingulata* indicated that only sulphur in the amorphous state was directly toxic, while colloidal sulphurs that are primarily crystalline were not toxic. Amorphous sulphur collected by vaporizing sulphur was toxic until it changed to a crystalline form.

Tests with the steam vapour application of fungicidal sprays [ibid., xvi, p. 696] in which the spray is heated to about 100 lb. pressure and applied as vapour showed that the method has the following advantages: the amount of spray material required for thorough coverage is reduced by about 75 per cent., cheaper materials can be used, and spray injury is lessened. The disadvantages are increased costs in fuel and time. The reduction in the cost of the spraying material equalizes the extra fuel expense, but the time factor remains. Tests with numerous common spray mixtures showed that wettable sulphurs were vaporized in fine particles, regardless of the original size of the particle, the

sulphur being vaporized in the amorphous state, sulphur and lime were vaporized as lime-sulphur very effectively, Bordeaux mixture was made safer but less fungicidal, and many insoluble copper compounds were rendered dangerous to foliage.

Winter found that satisfactory control of raspberry anthracnose [*Elsinoe veneta*: ibid., xv, p. 817; xvii, p. 121] resulted from one delayed dormant application of lime-sulphur, 1 in 10 to 1 in 30, whereas Bordeaux mixture (12–12–100), basic copper chloride, and coposil were unsatisfactory. The addition of a pre-blossom spray application in every case markedly reduced infection, even in the relatively dry season of 1936; Bordeaux mixture (4–8–100), basic copper chloride, and coposil were about equally effective when used as pre-blossom sprays. Lime-sulphur 1 in 50 caused serious foliage burning and stunting as a pre-blossom spray, and appears to be unsafe on black raspberries after the delayed dormant stage.

P. E. Tilford found that the causal organism of sweet pea fasciation (*Phytomonas fascians*) [ibid., xvi, p. 321] survives from one crop to the next mostly in the soil, the sterilization of which is the most important control measure. To a slight extent the organism appears to be borne on the outside of the seed coat of sweet peas, seed dusting with red copper oxide providing an effective treatment.

In spraying tests by J. D. Wilson and H. A. Runnels against *Alternaria* [*panax*] on ginseng [*Panax quinquefolium*: ibid., xii, p. 657] the results showed that a fungicide of low solubility, such as copper oxychloride, may give nearly as good control as Bordeaux mixture, if the former is used with a good spreader and sticker.

R. C. Thomas found that bacteriophages inhibiting growth and lysing homologous strains of *Apl*[*anobacter*] *stewarti* [ibid., xvi, p. 441] were generally present in field maize and in some of the hybrid varieties of sweet maize. They were not present in early pure-line strains of sweet maize, except occasionally in infected seed, which gave very few diseased plants. Whenever a plant showing typical symptoms recovered, a phage was associated with the infection. The seed of various grasses and cereal grains revealed the presence of the phage when water extracts were tested against two strains of *A. stewarti*.

Not one out of 200 raspberry plants propagated by Winter by the leafbud cutting method (each cutting consisting of a leaf with its axillary bud taken from the current year's cane) showed any sign of crown gall [*Bact. tumefaciens*: ibid., xiv, p. 219] after a year, though 50 per cent. of the plants in the parent planting were affected when the cuttings were made.

SMITH (C. O.). **Crown gall on Taxus baccata.**—*Phytopathology*, xxviii, 2, pp. 153–154, 1 fig., 1938.

About 70 per cent. of the inoculations made at Riverside, California, with cultures of *Pseudomonas* [*Bacterium*] *tumefaciens* isolated from peach and *Libocedrus decurrens* [*R.A.M.*, xvii, p. 19] on one-year or older branches of a nursery specimen of European yew (*Taxus baccata* var. *erecta*) were successful. The galls produced were somewhat smaller than those usually formed by the organism on susceptible hosts.

BERTHELOT (A.) & AMOUREUX (GERMAINE). **Sur la formation d'acide indol-3-acétique dans l'action de Bacterium tumefaciens sur le tryptophane.** [On the formation of indol-3-acetic acid in the action of *Bacterium tumefaciens* on tryptophane.]—*C. R. Acad. Sci., Paris*, ccvi, 7, pp. 537–540, 1938.

The tumours induced by indol-3-acetic acid in young sunflower plants cultivated under aseptic conditions being analogous to those resulting from inoculation with *Bacterium tumefaciens* [*R.A.M.*, xvii, p. 224], experiments were conducted to determine whether the crown gall organism elaborates this substance in appreciable quantities. In a nutrient solution containing tryptophane *Bact. tumefaciens* was in fact observed to form substantial amounts of indol-3-acetic acid at the expense of the tryptophane, the reaction to hydrochloric acid with traces of perchloride of iron being well marked after 24 hours and increasing in intensity up to the fourth day. Evidently indol-3-acetic acid plays an important part in the etiology of crown gall tumours, and the suggestion is made that the immunity from the disease of certain plants is in part conditioned by their exceptionally low tryptophane content.

DILLON WESTON (W. A. R.). **A field observation on Ophiobolus graminis.** —*Ann. appl. Biol.*, xxv, 1, pp. 209–210, 1938.

As an illustration of the inadvisability of too frequent a recurrence of a crop in rotation schemes the case is cited of a field in Norfolk which, in 1933, had been sown to barley, followed in 1934 by sugar beet, in 1935 by wheat on one half of the field and oats on the other, and in the next year by barley over the whole of the field. In 1936, the barley on the half which had been under wheat had about 60 per cent. of the tillers infected with *Ophiobolus graminis* [*R.A.M.*, xvii, p. 230] and its yield was assessed at half a sack to the acre, whereas the yield on the half preceded by oats was estimated at from six to seven sacks per acre. In the light of Garrett's recent studies on take-all [ibid., xvi, p. 306; xvii, p. 230], it is suggested that either the half of the field following wheat had been infected in 1935 with air-borne ascospores of *O. graminis*, the pseudosaprophytic or declining phase of which persisted on the dead wheat roots, or the 1933 barley crop had been infected and the declining phase lingered over in the soil to the autumn of 1935 when barley was sown; on the other half of the field where oats preceded barley, the fungus was apparently unable to survive on the roots of this crop, and the barley was a success.

MACHACEK (J. E.) & GREANEY (F. J.). **The 'black-point' or 'kernel smudge' disease of cereals.**—*Canad. J. Res.*, Sect. C, xvi, 2, pp. 84–113, 1 pl., 1 graph, 1938.

In giving a comprehensive review of the literature dealing with the pathological discoloration of wheat, barley, and rye grains which has been described under the names 'black point' [*R.A.M.*, xiii, p. 759; xv, p. 433], 'moucheture' [ibid., xiv, p. 91], and 'puntatura' [ibid. xii, p. 160], the authors suggest the term 'kernel smudge' for the condition

characterized by a dark or light brown, diffuse discoloration caused by fungi in any part of the grain, and more particularly in the region of the embryo. Examination of samples of wheat grown in Winnipeg from 1929 to 1935 showed that the condition is prevalent and of economic importance in Manitoba, and that apparently *durum* wheats are more susceptible to it than *vulgare* varieties. It was further found [by a plating method which is briefly described] that the fungi chiefly associated in Manitoba with this condition are *Alternaria tenuis*, *A. peglionii* [ibid., xv, p. 209] *Helminthosporium sativum*, and *H. teres*. Extensive trials demonstrated that the *Alternaria* kernel smudge (which macroscopically is indistinguishable from the *Helminthosporium* type) does not affect to any marked extent the germinability of the affected seeds, the emergence of seedlings, intensity of foot rot, or yield of the subsequent crop, whereas *H. sativum* reduced germination, seedling emergence, and yield, and also increased the amount of foot rot.

Under Manitoba conditions it was shown that the cereal grains are infected by air-borne spores of the fungi; by means of spore-traps it was demonstrated that the largest numbers of such spores usually occur in the air about the time when the grains are maturing. Frequently the largest grains in the ear are infected while the small, shrunken ones are usually free from the condition, and this is apparently due to the fact that the large kernels force open their covering glumes, thus affording access to the spores, whereas the glumes of small kernels remain closed and exclude the spores.

In special tests it was established that dusting wheat seeds affected with the virulent type of kernel smudge (*H. sativum*) with a suitable organic mercury dust (e.g., ethyl mercury phosphate or methyl mercury nitrate) considerably increased their seed value, while dusting with copper carbonate was relatively ineffective. Dusting the growing wheat plants with sulphur did not prevent the development of the disease.

JOHNSON (T.) & NEWTON (MARGARET). **The origin of abnormal rust characteristics through the inbreeding of physiologic races of Puccinia graminis tritici.**—*Canad. J. Res.*, Sect. C., xvi, 1, pp. 38–52, 1 pl., 1938.

The inbreeding of physiologic races of *Puccinia graminis tritici* by means of the selfing of selected strains for several successive generations gave rise to strains showing various abnormal characteristics, namely, greyish-brown, orange, or white uredosori; decreased vigour of sporulation manifested by a tendency to form uredosori unable to rupture the epidermis of the wheat plant; decreased virulence; increased sensitivity to high temperatures; inability to produce aecidia on the barberry; and the development of uredosori and teleutosori on the barberry [*R.A.M.*, xvi, p. 520] by some strains that have, partially or entirely, lost the ability to produce aecidia. Many inbred strains showed no abnormal characteristics. It is suggested that the abnormal characteristics mostly result from the segregation and recombination in a homozygous state of recessive mutations occurring in the past history of the rust.

KOVACHEVSKY [KOVAČEVSKI] (I. C.). Медният карбонатъ и употрѣблението му въ земедѣлието. Приносъ кѣмъ въпроса за борбата съ твърдата главня по Пшеницата. [Copper carbonate and its use in agriculture. A contribution to the problem of Wheat bunt control.]—41 pp., pamphlet issued by the Bulgarian Plant Protection Service, 1937. [English summary.]

In this paper the author gives an account of field trials from 1933 to 1936, inclusive, in Bulgaria, the results of which confirmed the efficacy of Borghardt's AB copper carbonate dust [*R.A.M.*, xiv, p. 47] in the control of wheat bunt (*Tilletia levis*) [*T. foetens*]. The preparation is relatively cheap and can be easily made by mixing two parts of ground copper sulphate with one of chalk and adding water. Its widespread use for the disinfection of wheat seed-grain in Bulgaria is strongly advocated.

HOUDAYER (C.). **Contribution à l'étude du traitement de la carie des Blés.** [Contribution to the study of Wheat bunt control.]—*Progr. agric. vitic.*, cix, 5, pp. 112–116, 1938.

The author states that extensive field trials in central France from 1934 to 1936, inclusive, showed that wheat grown from seed disinfected by sprinkling 100 kg. seed with 8 l. of a solution of potassium permanganate, 75 to 100 gm. per 100 l. water, was completely free from bunt [*Tilletia caries* and *T. foetens*], while control plots contained averages of from 2 to 7 bunted ears per sq. m. Besides its very low cost, the treatment has the further advantage over the similar treatment with 0·1 per cent. copper sulphate, that the seed treated with permanganate does not burst after sprinkling and its germination is advanced by four days, in comparison with that of the copper sulphate-treated seed.

VERESCIAGHIN (B. [V.]). О дезинфекціи сѣмянъ противъ мокрой, твердой и пыльной головни. [Disinfection of seeds against bunt, and loose and covered smuts.]—*Bul. agric. Basarabia, 1937*, 5, 2 pp., 1937.

The author points out that cereal seed grain disinfection against bunt (*Tilletia tritici*) [*T. caries*] and smuts (*Ustilago* spp.) has been rendered compulsory in Rumania by Order of the Ministry of Agriculture of 14th August, 1937, and briefly indicates the treatments applicable to the different diseases. The best control of wheat bunt is said to have been afforded by the old brand of porzol (of a reddish-brown colour, the new porzol, of a dark-purple colour being much less effective) [*R.A.M.*, xvi, p. 89] ceresan, and arzopol (Moscovitz); next in efficacy came antismut (Cooper), and cerealina (Caffaro).

HANNA (W. F.). **The association of bunt with loose smut and ergot.**—*Phytopathology*, xxviii, 2, pp. 142–146, 1 fig., 1938.

Kota wheat heads simultaneously infected by both *Ustilago tritici* and *Tilletia tritici* [*T. caries*] have been collected in the field at Winnipeg, Canada, and also produced in the greenhouse at the Dominion Rust Research Laboratory by artificial inoculation [*R.A.M.*, xvi, p. 239]. In the material examined, bunt has been confined to the upper, and loose smut to the lower part of the spike. Joint infection by *U. tritici*

and *T. caries* causes high seedling mortality; in greenhouse tests only 44 per cent. of the seeds inoculated with both smuts survived to maturity, as compared with 97 per cent. for the uninoculated controls. Competition between *U. tritici* and *T. caries* resulted in a marked suppression of infection by the latter.

On Little Club, Reward, Mindum, and Reward × Garnet wheat plants, bunt balls containing *T. caries* spores have been found fused to the projecting tips of ergot (*Claviceps purpurea*) sclerotia.

GREANEY (F. J.). **The effect of phosphate deficiencies on infection of Wheat by Fusarium culmorum.**—*Canad. J. Res.*, Sect. C., xvi, 1, pp. 27–37, 1 fig., 1938.

When Marquis wheat was grown for 36 days in pot cultures of quartz sand with different types of manuring, including a fully manured control and four series deficient in phosphate, one-half of the pots being inoculated with *Fusarium culmorum* [*R.A.M.*, xvii, p. 229] and sown with inoculated seed, the remainder serving as uninoculated controls, the results obtained [which are tabulated] showed that phosphate deficiencies did not significantly affect susceptibility to infection, though they significantly reduced root development and the total dry weight of the plants. Some indication was obtained, however, that high concentrations of phosphate tend to predispose wheat plants to infection. The results suggest that phosphates exert a much greater effect on plant growth and yield than on the severity of infection by *F. culmorum*.

VOLK (A.). **Biologie und Bekämpfung der Typhulafäule an Wintergerste.** [Biology and control of the *Typhula* rot of winter Barley.] —*Kranke Pflanze*, xv, 2, pp. 23–27, 5 figs., 1938.

This is an abridged version of the writer's studies on the rot of winter barley in Germany caused by *Typhula graminum*, a fuller account of which has already been noticed from another source [*R.A.M.*, xvi, p. 802].

REED (G. M.) & STANTON (T. R.). **Inheritance of resistance to loose and covered smuts in Markton hybrids.**—*J. agric. Res.*, lvi, 3, pp. 159–175, 3 figs., 1938.

A detailed account is given of experiments in which the authors studied the reaction to Missouri races of *Ustilago levis* [*U. kolleri*] and *U. avenae* [*R.A.M.*, xvii, p. 234] of hybrids resulting from crosses between Markton oats, highly resistant to both smuts, on the one hand, and on the other, the varieties Canadian, Early Champion (and its reciprocal), and Victor, all susceptible to both smuts, Gothland, susceptible to the loose and resistant to the covered smut, and Monarch, susceptible to the covered and resistant to the loose smut. In F_2 plants of the three first-named crosses artificial inoculation with *U. avenae* resulted in low percentages (8·6 to 16) of infection, higher percentages (20 to 32·5) being obtained with *U. kolleri*. F_3 populations inoculated with both smuts showed no agreement in their reaction to the smuts. These results may suggest a two-factor difference in the oat varieties in

respect of loose smut and a single-fact or difference in respect of covered smut. In both the F_2 and F_3 generations there was a noticeable lack of progenies fully susceptible to the two smuts. F^2 plants of hybrid 56, Gothland × Markton, inoculated with loose smut gave 17·1 per cent. infection, and 72·6 per cent. of the F_3 progenies descended from uninoculated F_2 plants were segregating, the others being resistant. No completely susceptible progenies were observed. A few of the F_2 plants and some of the F_3 progenies were infected with covered smut. Of the F_2 plants of hybrid 60, Monarch × Markton, 22 per cent. became infected when inoculated with covered smut, and 74·4 per cent. of the F_3 progenies descended from uninoculated F_2 plants contained smutted individuals. These data suggest a single factor difference, although there is a noticeable lack of susceptible F_3 progenies. A few of the F_2 plants inoculated with loose smut were infected and smutted plants were also found among several F_3 progenies.

Marchionatto (J. B.). **Argentine Republic: 'fermented' Maize ears and control measures.**—*Int. Bull. Pl. Prot.*, xii, 2, pp. 25–26, 1938.

The writer reports the occurrence of *Diplodia zeae* on maize ears in the province of Buenos Aires, Argentine Republic, briefly describes the symptoms of infection, and indicates control measures. Surveys at maize storage centres indicate that the disease is not very extensively distributed, and in the most serious outbreaks, in Pergamino, only affected 2 per cent. of the crop. In commerce affected grain is known as 'fermented' seed.

Mains (E. B.). **Two unusual rusts of grasses.**—*Mycologia*, xxx, 1, pp. 42–45, 1 pl., 1938.

After briefly referring to a recent paper, in which he erected the genus *Angiopsora* for a group of rusts with catenulate teleutospores on grasses (*Mycologia*, xvi, pp. 122–132, 1934), the author describes [with Latin and English diagnoses] under the name *A. zeae* n.sp. a rust collected on maize in Guatemala and also reported from Porto Rico and Trinidad. It is characterized by sessile, obovoid or ellipsoid, hyaline or yellowish uredospores, 22 to 34 by 16 to 20μ, and angularly ellipsoid or oblong, golden-brown, catenulate teleutospores in rows of one to three (usually two), measuring 16 to 38 by 12 to 18μ. Macroscopically it differs from the widespread maize rust (*Puccinia sorghi*) [*P. maydis*: *R.A.M.*, xvi, p. 19] in that its teleutosori remain covered by the epidermis, and in the light yellow colour of its uredosori.

P. apoda Har. & Pat. on *Pennisetum setosum* is referred to the genus *Phakopsora* under the name *P. apoda* comb. nov., and a revised English description of the fungus is appended.

Johnston (C. O.), Lefebvre (C. L.), & Hansing (E. D.). **Observations on the loose kernel smut of Johnson Grass.**—*Phytopathology*, xxviii, 2, pp. 151–152, 1 graph, 1938.

The smut infecting Johnson grass (*Sorghum halepense*) in Kansas and Oklahoma in 1935 and 1936, respectively, was identified by G. L. Zundel as most closely resembling *Sphacelotheca holci*, described by

H. S. Jackson on specimens of sorghum collected by C. E. Chardon and collaborators in Venezuela (Mycological explorations, 1934) [*R.A.M.*, xiv, p. 397]. The differences between *S. holci* and the loose kernel smut, *S. cruenta*, a new physiologic race of which on Johnson grass has recently been reported by H. A. Rodenhiser [loc. cit.], are of the same order as those between separate species of certain other smuts, e.g., those of oats [*Ustilago avenae* and *U. kolleri*], but are less sharply defined than those characterizing various physiologic races of *T. tritici* [*T. caries*: ibid., xv, p. 287; xvii, p. 381]. The chlamydospores of *S. holci* are larger, more prominently echinulated, and somewhat darker than those of *S. cruenta*, while the sporidia and promycelia of the former are also longer than those of the latter. Smutted Johnson grass plants are stunted, profusely tillered, and branched, forming panicles prematurely. The sori of the smut are characterized by early peridial fragmentation and the presence of a long, prominent columella. These features, together with the similarity of the spores, point to a relationship between the Johnson grass smut and *S. cruenta*, but the failure of the former to infect many species of cultivated sorghum denotes a somewhat distant connexion.

Melchers (L. E.) & Hansing (E. D.). **The influence of environmental conditions at planting time on Sorghum kernel smut infection.**—*Amer. J. Bot.*, xxv, 1, pp. 17–27, 6 graphs, 1938.

In field studies conducted over a period of five years at Manhattan, Kansas, plantings of sorghums were made at weekly intervals to determine the relationship of environmental factors to infection by kernel smut (*Sphacelotheca sorghi*) [*R.A.M.*, xvi, p. 666]. Reaction to this smut can best be determined by planting from 10 to 14 days earlier than usual, since early planting prevents the plants from escaping smut. The results substantiated those obtained by Reed and Faris in the greenhouse [ibid., iv, p. 158]. Soil temperature and soil moisture are interdependent factors in determining the infection of sorghum by kernel smut. Medium to low soil temperatures with medium to low soil moistures appeared to be most conducive to maximum infection. Moderate infection occurred over a very wide range of soil temperatures and soil moistures. Heavy infection occurred at all temperatures under 75° F. which permitted seed germination, low soil temperatures being consistently associated with high infection. A minimum of 28° during the infection period in no way hindered infection. As a general rule, infection was reduced when the mean maximum soil temperatures during the infection period were 75° or over, though during the germination and infection periods one or two high temperatures may inhibit infection, even when the average of the maximum temperatures does not appear adverse to infection under field conditions. Soil moistures of 28 per cent. or more on the dry basis considerably reduced infection, even under favourable soil temperature conditions. Soil moistures of under 8 or 10 per cent. on the dry basis appeared to reduce infection, but when the soil moisture remains at this point sorghum seed does not germinate. When soil moisture, after rain, becomes high enough for germination, some infection may occur, i.e., infection can take place in any degree of soil moisture in which sorghum seed will germinate.

MEHTA (P. R.) & CHAKRAVARTY (S. C.). **A new disease of Eleusine coracana Gaertn.**—*Indian J. agric. Sci.*, vii, 5, pp. 793–796, 6 figs., 1937. [Received May, 1938.]

A new disease of *Eleusine coracana* is reported from Benares. The affected plants were stunted, pale, and tufted in appearance, often produced very short internodes, and formed numerous sterile lateral shoots from the upper nodes and abundant white adventitious roots from the aerial nodes. Tillering and length of life were, however, normal. Although *Piricularia* spp. were isolated from numerous lesions of the leaf blades of younger plants and microscopic examination revealed the presence of bacteria in the intercellular spaces of some of the discoloured patches of the phloem of root and stem, rarely in the cells themselves, the exact cause of the disease has not yet been determined. The disease was first observed in a plot with somewhat defective drainage.

BAKER (R. E. D.). **Citrus scab disease on Grapefruit in Trinidad.**—*Trop. Agriculture, Trin.*, xv, 4, pp. 77–79, 1938.

Citrus scab caused by *Elsinoe fawcetti*, first observed in quantity on Marsh grapefruit trees in Trinidad, in January, 1937 [*R.A.M.*, xvi, p. 527], was deduced from the age of the diseased leaves to have appeared first on the grapefruit in October or November, 1936. Further outbreaks have occurred since then whenever weather conditions have been suitable, and although the infected area is to leeward of many big estates and the spread of infection by the wind may therefore be slow, it is expected that it will almost certainly invade other areas in the course of time. The risk of spreading the disease through the exchange of field boxes in the central packing-house should be minimized by careful disinfection of the boxes. Temperature and humidity records kept on the affected estate for a period of nine months show that weather conditions suitable for scab infection of leaves and fruits occurred only four or five times during 1937.

The Trinidad 'grapefruit strain' of the fungus appears to differ slightly from the other Trinidad isolations. A series of cross-inoculations of grapefruit and sour orange, carried out in the laboratory and in the field and repeated several times with consistent results, proved that the strains from each of them were only capable of attacking their own host; a 'rough lemon strain' of the fungus was also unable to attack grapefruit. The results of these experiments, supported by field observations and the study of the fungus in pure culture, leads to the conclusion that the 'grapefruit strain' is a recent mutation from the 'sour orange strain'. Under Trinidad conditions spraying against the disease will be difficult and costly, but experiments in this connexion have been instituted.

BITANCOURT (A. A.). **A rubellose.** [Pink disease.]—*Biologico*, iv, 1, pp. 17–18, 1 fig., 1938.

A popular account is given of pink disease (*Corticium salmonicolor*) of citrus [*R. A. M.*, xvi, p. 451] and other fruit trees, which is stated to be fairly prevalent in Brazil. The trouble may be easily controlled by

carefully cutting out all infected branches and twigs as soon as the first symptoms appear, but neglect may lead to the partial or total death of whole trees. The pruning wounds should be immediately dressed with Bordeaux paste.

Progress Reports from Experiment Stations, season 1936–1937.—129 pp., 1 plan, 4 graphs, London, Empire Cotton Growing Corporation, 1938.

These reports [cf. *R.A.M.*, xvi, p. 455] contain, *inter alia*, the following items of interest. At Barberton, South Africa, some blocks of cotton were badly damaged by *Alternaria* [cf. ibid., viii, p. 306; xi, p. 638]. The premature leaf fall caused by the fungus has not previously seriously affected the local yields, the disease generally appearing too late in the season, and being mainly associated with very early strains that have matured their crop, or with cotton on poor soil.

There would appear to be a close connexion between maize streak [ibid., xvii, p. 160] and the distribution of the early rains in S. Africa. In the preceding season, when the spring rains were light and very late, there was very little streak throughout the season, but in 1936–7, when the rains arrived very early and were abundant, infection was of unprecedented severity, and plantings of susceptible strains made early in December developed about 66 per cent. infection by the end of January. A field of American White Flint maize planted on 31st December was very badly attacked, only 23 out of 21,300 plants being unaffected at a count made in February. Out of the 20 best selections of the variety Peruvian nine had not one infected plant.

Blackarm [*Bacterium malvacearum*: ibid., xvii, pp. 35, 239] of cotton was general but not severe in the Gezira area of the Anglo-Egyptian Sudan, where leaf curl [ibid., xvi, p. 175] development was slow on Sakel, and almost non-existent on X. 1530. Details are given of further progress in breeding work against *Bact. malvacearum* [ibid., xvii, p. 315] at Shambat and Serere. In tests against wilt [*Verticillium dahliae* and *Fusarium* spp.: ibid., xvii, pp. 295, 392] seven American varieties resistant to wilt in their country of origin failed to show complete resistance in Uganda.

The death of a few patches of cotton early in the season in Nyasaland was associated with *Macrophomina phaseoli*.

In St. Vincent, West Indies, rain fell on 28 days in January, 1937, with resultant high incidence of cotton boll rot (*Phytophthora* spp.) [ibid., x, p. 102] and blackarm.

Morrow (Marie B.), Roberts (J. L.), Adams (J. E.), Jordan (H. V.), & Guest (P.). **Establishment and spread of molds and bacteria on Cotton roots by seed and seedling inoculation.**—*J. agric. Res.*, lvi, 3, pp. 197–207, 4 diags., 1938.

In these studies [a brief reference to which has been noticed from another source: *R.A.M.*, xvii, p. 172], the authors show that the three moulds *Aspergillus luchuensis*, *Penicillium luteum*, and *Trichoderma lignorum*, already proved in the laboratory to be antagonistic to *Phymatotrichum omnivorum*, became established and apparently multiplied in the rhizosphere of cotton plants in experimental plots

artificially inoculated with these organisms, though *Penicillium luteum* was also isolated from uninoculated soil. The results of parallel tests with the antagonistic bacteria *Pseudomonas fluorescens* and *Achromobacter* [*Bacterium*] *radiobacter* were considered to be uncertain, because of the poor recovery of these organisms from the rhizospheres.

WATKINS (G. M.). **Cytology of Phymatotrichum root rot of Cotton seedlings grown in pure culture.**—*Amer. J. Bot.*, xxv, 2, pp. 118–124, 21 figs., 1938.

Roots of cotton seedlings grown aseptically and inoculated with *Phymatotrichum omnivorum* [*R.A.M.*, xvi, p. 454, and preceding abstract] in pure culture were gradually covered by a dense weft of fungous hyphae. Sections of roots fixed at 24-hour intervals showed that roots coming into contact with the cut surface of the sclerotium, or agar discoloured by a sclerotium, are usually inhibited in growth and occasionally develop sunken necrotic areas even before being attacked by hyphae. The agglomeration of hyphae over the root either brings about the death of the epidermis and cortex down to the central cylinder or single hyphae penetrate the epidermis and ramify through and between the cells of the cortex, endodermis, pericycle, and ultimately in the tracheids of the xylem. While the penetration process may conceivably involve a combined mechanical and chemical activity on the part of the fungus, the cytological evidence indicated a dominant part played by enzymic exudates. As far as has been observed, no symbiotic association of fungus and living host cells took place and moribund root cells were frequently seen as much as four cell layers from the fungus. No evidence was seen of the 'mechanical wedge' type of penetration [ibid., vi, p. 227] which has been reported by various other authors from field experiments.

KATSURA (S. K.). **Inoculation of young Cicada nymphs with spores of green muscardine disease.**—*J. econ. Ent.*, xxxi, 1, pp. 124–125, 1 fig., 1938.

Nymphs of the periodical cicada (*Magicicada septendecim*) on peach twigs from Virginia trapped at Maryland University in Petri dishes containing damp soil contaminated with the spores of *Metarrhizium anisopliae* [*R.A.M.*, xvii, p. 36] mostly succumbed in 15 to 24 hours, while those in a control plate on sterile, moist filter paper survived for the normal period of 4 to 15 days. The white, cottony mycelium of the fungus began to develop profusely on the bodies of the insects four to five days after inoculation.

JOHNPULLE (A. L.). **Temperatures lethal to the green muscardine fungus, Metarrhizium anisopliae (Metch.) Sorok.**—*Trop. Agriculturist*, xc, 2, pp. 80-83, 1 graph, 1938.

In laboratory tests [details of which are given] spores of *Metarrhizium anisopliae* [see preceding abstract] isolated from coco-nut beetle (*Oryctes rhinoceros*) larvae were shown to germinate at temperatures below 48° C. It is possible therefore that the fungus may be used for the biological control of the beetle in compost pits laid down on coco-nut land, since the temperature within the pits falls to well below 48°

about six weeks after laying down, when the compost can be safely inoculated with the organism.

SPARROW (F. K.). **The morphology and development of Obelidium mucronatum.**—*Mycologia*, xxx, 1, pp. 1–14, 44 figs., 1938.

A detailed account is given of the author's studies on the morphology and development of *Obelidium mucronatum* found in submerged exuviae of midges [Chironomidae] and caddis flies [Phryganeidae] in the vicinity of Ann Arbor, Michigan [*R.A.M.*, xvii, p. 173].

LINFORD (M. B.) & YAP (F.). **Root-knot injury restricted by a nematode-trapping fungus.**—Abs. in *Phytopathology*, xxviii, 1, pp. 14–15, 1938.

In a comparative experiment [? in Hawaii] pineapples were cultivated over a period of 15 months in steamed soil (A and B) without nematodes, (C and D) with *Heterodera marioni*, (E and J) with nematodes plus six isolates of nematode-trapping Hyphomycetes [*R.A.M.*, xvii, p. 318] grown in a nutrient-bagasse medium. Nematode infestation diminished pineapple top growth by 40, 34, and 28 per cent. without bagasse, with bagasse, and with bagasse plus *Dactylella ellipsospora*, respectively, the corresponding reductions in total root length amounting to 73, 69, and 57 per cent., respectively. Reisolations from galled roots showed that the experimentally introduced trapping fungi remained dominant during the period covered by the tests.

SOUCHARD & NGUYEN-VAN-HUONG. **La piedra noire en Cochinchine.** [The black 'piedra' in Cochin-China.]—*Ann. Parasit. hum. comp.*, xv, 6, pp. 539–543, 3 figs., 1937.

A brief account is given of morphological and cultural studies, the results of which showed that the nodules which are frequently found on the hairs of natives in Cochin-China, French Indo-China, are caused by a fungus apparently identical with *Piedraia hortai* [*R.A.M.*, xiii, p. 513] as judged from Horta's description of the Brazilian organism. This is stated to be the first known record of the fungus in Indo-China.

BALDACCI (E.). **Contributo alla sistematica degli Attinomyceti. I. Sull'Actinomyces bovis Harz e sull'Actinomyces sulphureus Gasp.** [A contribution to the systematics of the Actinomycetes. I. *Actinomyces bovis* Harz and *A. sulphureus* Gasp.]—*Atti Ist. bot. Univ. Pavia*, Ser. IVa, ix, pp. 243–271, 2 figs., 1937. [Latin and English summaries.]

This is an expanded account of work already noticed from other sources [*R.A.M.*, xv, p. 650; xvi, p. 774].

GERMAIN (A.) & MORVAN (A.). **A propos du diagnostic du rhumatisme cérébral; méningo-encéphalite aiguë à 'Torulopsis histolytica'.** [On the diagnosis of cerebral rheumatism; acute meningo-encephalitis due to *Torulopsis histolytica*.]—*Bull. Soc. méd. Hôp. Paris*, Sér. 3, liv, 5, pp. 231–234, 1938.

Clinical details are given of a fatal case of acute meningo-encephalitis in a 19-year-old naval gunner in France, associated with the presence in the spinal fluid of the circular, yeast-like cells of *Torulopsis histolytica*

[*Debaryomyces neoformans* or *Cryptococcus hominis*: *R.A.M.*, xvii, p. 394].

Gougerot (H.), Giraudeau, & Patte (A.). **De l'utilité de la lumière de Wood en dermatologie.** [On the utility of Wood's rays in dermatology.]—*Bull. Soc. franç. Derm. Syph.*, *1938*, 2, pp. 345–350, 1938.

Details are given of the writer's experiments in France on the application of Wood's rays [*R.A.M.*, xvii, p. 175], with eminently satisfactory results, to the diagnosis, prognosis, and therapy of miscellaneous human dermatoses, including pityriasis versicolor (*Malassezia furfur*) [ibid., xvii, p. 243].

Simon (F. A.). **Allergic conjunctivitis due to fungi.**—*J. Amer. med. Ass.*, cx, 6, p. 440, 1938.

The following evidence is adduced in support of the writer's conclusion that air-borne fungal spores were the chief etiological factor in a case of conjunctivitis in a 38-year-old man at Louisville, Kentucky. Seasonal variations in the symptoms coincided with similar changes in the atmospheric concentration of fungus spores. The trouble was consistently relieved during the patient's absence from the particularly humid conditions of his place of residence, from the air of which fungi were cultured in abundance. Skin tests with *Alternaria* and *Cladosporium* extracts were definitely positive [cf. *R.A.M.*, xvii, p. 243], and the clinical features of the disturbance were reproduced by the application of the *Alternaria* extract to the conjunctiva, a control test on a non-sensitive subject being negative. Desensitization with fungus extracts resulted in a pronounced improvement in the patient's condition.

Joltrain (E.). **Aspergillose pulmonaire primitive et pure évoluant depuis 15 ans.** [Primary and pure pulmonary aspergillosis of 15 years' duration.]—*Bull. Soc. Méd. Paris*, cxli, 8, pp. 327–337, 2 figs., 1937. [Abs. in *Bull. Inst. Pasteur*, xxxvi, 8, pp. 431–432, 1938.]

Clinical details are given of an illness of 15 years' duration simulating pulmonary tuberculosis and progressively involving the heart of a female patient in Paris. The sole organism obtained in pure culture from the sputum, however, proved to be *Aspergillus fumigatus* [*R.A.M.*, xvi, pp. 456, 611], injections with an alcoholic extract of which induced positive skin reactions. A marked distinctive feature of the case was the vivid red coloration of the bronchi.

Wollenweber (H. W.) & Krüger (E.). **Die Septoria- oder 'Pasmo'-Krankheit des Leins in Deutschland.** [The *Septoria* or 'pasmo' disease of Flax in Germany.]—*NachrBl. dtsch. PflSchDienst*, xviii, 2, pp. 11–12, 1938.

Six out of 21 samples of German-grown flax from experimental plots examined at Dahlem, Berlin, towards the end of 1937 were found to be contaminated by *Septoria linicola*, the agent of the 'pasmo' (spasm) disease originally described from the Argentine and recently found on

material received from Belgrade [*R.A.M.*, xvi, p. 676]. Since it is not to be expected that the fungus will remain confined to the test plantings on which it originated, further investigations on the disease, and particularly the manner of its dissemination, are urgently required.

MAMELI-CALVINO (EVA). **Rassegna dei casi fitopatologici osservati nel 1937.** [Review of phytopathological observations in 1937.]—*Costa azzur. agric.-flor.*, xviii, 1–2, pp. 11–17, 1 fig., 1938.

Notes are given on a large number of plant diseases (chiefly of flowers and fruit) observed during 1937 on the Italian Riviera [cf. *R.A.M.*, xv, p. 22; xvi, p. 463], including *Bacterium solanacearum* on dahlias [ibid., xiii, p. 495], causing the stems to wither to a height of 5 to 7 cm. from the collar, followed by a sudden wilt of the plants, and *Bact. matthiolae* on *Matthiola incana* [ibid., xiii, p. 306] producing green, later brown, irregular spots on the leaves and stems, infection spreading to the roots, and the plants quickly dying. The latter disease was to some extent controlled by treatment of the affected plants with 0·03 per cent. cerere.

BEWLEY (W. F.). **Recent work on Rose diseases.**—*Sci. Hort.*, vi, pp. 97–101, 1938.

A survey is given of recent work at Cheshunt on the rose diseases caused by *Coniothyrium rosarum* [*Leptosphaeria coniothyrium*: *R.A.M.*, xv, p. 653], black spot (*Diplocarpon rosae*) [loc. cit.], rust (*Phragmidium* sp.) [ibid., xvi, p. 726], and mildew (*Sphaerotheca pannosa*) [loc. cit.].

BRIERLEY (P.) & MCKAY (M. B.). **Experiments with aphids as vectors of Tulip breaking.**—*Phytopathology*, xxviii, 2, pp. 123–129, 1938.

Both the 'colour-removing' and 'colour-adding' viruses (tulip viruses 1 and 2 respectively) of tulip breaking [*R.A.M.*, xii, p. 292; xiii, p. 446] were shown by experiments at the Oregon Agricultural Experiment Station from 1926 to 1930 to be transmissible by *Myzus persicae* and *Macrosiphum solanifolii*, but earlier reports as to the ability of *Myzus solani* to convey the disease from infected to healthy plants were not confirmed. In one test *M. circumflexus* was apparently instrumental in the transmission of breaking, but evidently neither of the bulb-infesting species, *Anuraphis tulipae* and *Rhopalosiphoninus tulipaella*, was concerned in the spread of infection. In none of the experiments did breaking symptoms develop during the season of inoculation.

WHITE (H. L.). **Stem rot and wilt of the perpetual flowering Carnation.**—*Sci. Hort.*, vi, pp. 86–92, 1938.

Notes, based on studies conducted at Cheshunt Experimental and Research Station from 1925 to 1928 and in 1934–35, are given on the mode of infection and control of carnation stem rot (*Fusarium culmorum*) and the wilt caused by *Verticillium cinerescens*. Most of the information given has already been noticed in this *Review* [cf. xv, p. 654; xvi, p. 726].

BROWN (W.). **Stem-rot and wilt of the perpetual flowering Carnation.**—*Sci. Hort.*, vi, pp. 93–97, 1938.

This is a popular account of the carnation diseases caused by *Fusa-*

rium culmorum, *F. dianthi*, and *Verticillium cinerescens* and their control [*R.A.M.*, xvii, p. 182; and preceding abstract].

FISCHER (R.). **Beobachtungen über die Anfälligkeit der Chrysanthemum-Sorten.** [Observations on the susceptibility of Chrysanthemum varieties.]—*Blumen- u. PflBau var. Gartenwelt*, xlii, 8, p. 88, 1938.

With reference to Böhmig's recent observations on the reaction of chrysanthemums to rust [*Puccinia chrysanthemi*], *Septoria* [? *chrysanthemella*], and mildew [*Oidium chrysanthemi*] in Germany [*R.A.M.*, xvii, p. 181], the writer contributes the following notes on the susceptibility of some standard varieties at a Berlin municipal garden. (1) Large-flowered: H. E. Converse is very slightly and Princess v. Zehlendorf and Red Majestic slightly attacked by mildew, to which La Cagouille, Mme. Bringuier, and Jenkins are highly susceptible, susceptible, and fairly susceptible, respectively. Bernea, La Cagouille, and Mrs. R. C. Pulling are resistant to rust and to the *Septoria*, while D'Aubigny, Jenkins, Dr. Stresemann, and Red Majestic are highly susceptible, susceptible, susceptible and moderately susceptible, respectively. (2) Small-flowered: Perle v. Vierlanden, Ada Owen, and Majumbo are all liable to severe infection by rust and *Septoria*, the first-named, however, escaping under late propagation conditions. Blanche Poitevine, Hammelfänger, Pink Profusion, Rolf Curtis, and Rosenelfe are all susceptible to both diseases (the first-named, however, is not attacked in the open), while Ilse Wolf is resistant.

CAMPBELL (MARIE E.). **A disease of the Viola caused by Ramularia deflectens.**—*Ann. appl. Biol.*, xxv, 1, pp. 115–121, 1 pl., 2 figs., 1938.

Morphological and cultural studies of the fungus forming dark-coloured lesions, starting at the edge and gradually spreading inwards, on the leaves of Kate Blyth violas received in 1934 from Coventry, showed that the organism agreed in every respect with Lindau's description (1907) of *Ramularia deflectens* Bres., except in the size of the conidia which varied from 6·9 to 24·1 by 2·2 to 3·4 μ in diameter, as against 18 to 40 by 5 to 7 μ given in the diagnosis; a tendency was observed for the conidia produced on artificial infections on the host to be larger than those formed in culture. Immediately below the epidermis the leaves bore spherical to flask-shaped sclerotium-like bodies, 30 to 70 μ in diameter, the larger ones showing hyphae with small spores attached to their ends protruding from a definite papilla which projected through the ruptured epidermis; from comparison with pycnidia developed in pure culture on certain nutrient media, these bodies are considered to be true pycnidia which have not developed fully. Perithecia were found neither on the host nor in culture, but the presence of the pycnidia seems to warrant the withdrawal of the fungus from the Moniliales. Infection experiments in August, 1934, on two varieties of viola gave negative results, but were successful on the Kate Blyth variety in February, 1935, indicating that *R. deflectens* is a weak parasite attacking violas in early spring.

CANONACO (A.). **Una malattia del Tropaeolum majus L. dovuta ad un Ifale del genere 'Oidiopsis' Scal.** [A disease of *Tropaeolum majus* L. due to a Hyphomycete of the genus '*Oidiopsis*' Scal.]—*Lav. Ist. bot. Palermo*, viii, pp. 31–46, 1 pl., 1 fig., 1937.

Tropaeolum majus plants at Palermo have been affected for three successive years by a fungus, morphologically identical with *Oidiopsis sicula* [? *O. taurica*: *R.A.M.*, xi, pp. 281, 605], which produces small, yellow spots on the upper surface of the leaves with a powdery mass of conidiophores and conidia on the under surface. After a few days, the spots turn reddish-violet, but subsequently dry up, only the edges remaining coloured. The lesions are very numerous (up to 50 per leaf), irregularly shaped, and generally 4 to 6 mm. in diameter (1½ cm. when confluent). On some leaves most of the spots are arranged along the margins, which roll up, causing the leaf to become cup-shaped. Infection begins on the lower surface, and the mycelium, which bears globose haustoria, penetrates into the palisade tissue. In 1936, probably owing to the preceding mild winter, spotting was sparse, and most of the affected leaves showed a diffused chlorosis.

WENZL (H.). **Oidium tuckeri Berk. auf Parthenocissus tricuspidata Planch.** [*Oidium tuckeri* Berk. on *Parthenocissus tricuspidata* Planch.]—*Z. PflKrankh.*, xlviii, 2, pp. 57–59, 1 fig., 1938.

Oidium tuckeri [*Uncinula necator*] was detected on the yellowish-brown, necrotic areas on Virginia creeper (*Parthenocissus tricuspidata*) foliage in a private garden in Vienna, where the discoloration, accompanied by extensive defoliation, was first observed at the end of May, 1936. Although causing appreciable damage to its host, the fungus was poorly developed, the superficial mycelium being invisible to the naked eye, and the production of conidia scanty. This is believed to be the first record of the true mildew of vine on *P. tricuspidata*.

DODGE (B. O.). **A further study of the dry-rot disease of Opuntia.**—*Mycologia*, xxx, 1, pp. 82–96, 4 pl., 1 fig., 1938.

Further studies of the dry rot of an unidentified species of *Opuntia* from New Mexico, recently described by the author [*R.A.M.*, xvi, p. 816], showed that the invasion of the host by the fungus is at first fairly rapid, but is later stopped by the formation of a callus layer cutting off the healthy tissue. The only fruiting bodies so far found are minute pycnidium-like structures which may possibly be spermogonia, and the cavities of which are developed in stromatic tissue through disorganization. It is possible that Seaver based his *Phyllosticta concava* (*N. Amer. Flora*, vi, p. 13, 1922) on this or a similar organism, and it is suggested that it be referred to provisionally under the name *P. concava*, although the fruiting body is not that of a typical *Phyllosticta*. Diseased specimens of *O. dillenii* sent by J. M. Waterston from Bermuda bore three or four different types of fruiting bodies, the most common of which is described [with a Latin diagnosis] as *Leptodermella opuntiae* n.sp.; it has pinkish, fleshy pycnidia at first subgloboid, 100 to 170 μ in diameter, and non-ostiolate; filiform conidiophores; and hyaline, unicellular conidia, 3 to 4·5 by 1 to 1·5 μ. Four of the specimens show

perithecia which may belong to a *Mycosphaerella*, and two bore large numbers of *P. concava* pycnidia.

GREGOR (MARY J. F.). **Associations with fungi and other lower plants.**—*ex* Manual of Pteridology (ed. F. Verdoorn, The Hague, Holland, M. Nijhoff), pp. 141–158, 2 figs., 1938.

This is a comprehensive, fully documented summary of our knowledge of the diseases of ferns, Equisetinae, and Lycopodiinae, caused by fungi, Myxomycetes, bacteria, nematodes, and viruses.

CHITTENDEN (E.) & THOMSON (R. H. K.). **The effect of borax top-dressing on the storage quality of Jonathan Apples.**—*N.Z. J. Sci. Tech.*, xix, 9, pp. 541–546, 1 fig., 1 graph, 1938.

Particulars are given of experiments on a block of 48 Jonathan apple trees on a poor soil phase of the Moutere Hills, Nelson, New Zealand, to determine the effect of borax top-dressings, as applied for the control of internal cork [*R.A.M.*, xvii, p. 255] at rates of $\frac{1}{2}$, 1, and 3 lb. per tree, on the keeping quality of the fruit in storage at 38° F.

It was found that, after six months in storage, the incidence of internal breakdown was appreciably increased even by the $\frac{1}{2}$ lb. treatment (35 as compared with 11 per cent. in the controls), the corresponding figures for the 1 and 3 lb. applications being 57 and 81 per cent., respectively. Fungal rots [unspecified] also increased on a roughly parallel scale, amounting to 6, 23, and 41 per cent., respectively, for the three borax treatments compared with 1 per cent. in the controls. Under the somewhat heavy local rainfall conditions the trees were found to have absorbed relatively large quantities of boron, namely 30, 80, and 111 p.p.m. in samples from the three treatments, corresponding to 21, 45, and 71 per cent. internal breakdown and to 6, 23, and 41 per cent. fungal rots, respectively; the controls showed 7 and 1 per cent., respectively, of breakdown and decay and contained 17 p.p.m. boron.

It is apparent from these data that the maximum spring borax dressing for Jonathans, even on soils liable to serious internal cork, should not exceed $\frac{1}{2}$ lb. per tree. Further evidence to the same effect was received, subsequent to the preparation of this paper, from W. R. L. Williams, of Alexandra, who found the fruit from ten Ballarat seedling apples treated with $\frac{2}{3}$ lb. borax per tree in a very poor condition in October after storage since May. Eleven of the apples examined at the Cawthron Institute showed severe internal breakdown and fungal rot, and contained 53 p.p.m. boron.

CARNE (W. M.) & MARTIN (D.). **Apple investigations in Tasmania: miscellaneous notes. 8. The influence of carbon dioxide concentration on brown heart and other storage disorders.**—*J. Coun. sci. industr. Res. Aust.*, xi, 1, pp. 47–60, 5 graphs, 1938.

In this progress report on further investigations carried out in Tasmania on the storage disorders of apples [*R.A.M.*, xv, p. 299] the results are given of tests involving continuous storage for 8 weeks in low concentrations of carbon dioxide, pre-storage treatment with high concentrations of carbon dioxide, and carbon dioxide accumulation during the early part of storage. The conclusions tentatively reached may be summarized as follows.

Sturmer, French Crab, and Jonathan apples are, respectively, very susceptible, susceptible, and relatively resistant to brown heart [see above, p. 443]. The danger of injury by high concentrations of carbon dioxide depends on the maturity of the fruit and the period of exposure. A concentration of 3 per cent. carbon dioxide caused brown heart in Sturmer apples picked in May and kept at 32° to 34° F. for 8 weeks, while one of 12 per cent. caused injury in 7 days. Sturmer apples picked in May and kept in unventilated storage at 38° and 44° developed brown heart in 3 and 5 days, respectively. Carbon dioxide production by Sturmer apples increases up to a stage of maturity and then declines. Delay between picking and cooling Sturmer apples hastens ripening, and increases liability to brown heart, whereas cooling before unventilated storage reduces carbon dioxide production and delays the onset of brown heart. When accumulation of carbon dioxide becomes dangerous, rapid ventilation is better than slow. Brown heart develops slowly in apples kept in carbon dioxide, and at least 48 hours' exposure to the air at 50° to 60° is required for the full development of the symptoms after a storage period of two or three weeks.

Sturmer, French Crab, and Jonathan apples show the same relative susceptibility to alcoholic poisoning [ibid., xv, p. 300] as to brown heart, though susceptibility is generally less to the former than to the latter. Susceptibility to alcoholic poisoning increases with carbon dioxide concentration, but declines with increase in temperature. The disorder occurs below 38°.

Pre-storage treatment with high concentrations of carbon dioxide did not reduce low-temperature breakdown, but appeared to increase it in early pickings of Cox's Orange Pippin. Carbon dioxide in the storage air appeared to increase Jonathan spot, while pre-storage treatment with high concentrations of carbon dioxide had the same effect, and increased a similar spotting of Scarlet Pearmain apples. Lenticel scald (a browning of the lenticels in the centre of small, brown, depressed spots) in Sturmer apples was increased by carbon dioxide in the storage air, and by increase of the storage temperature. Late scald [see above, p. 443] (a general, irregular, indefinite browning of the skin of apples stored for prolonged periods at cool and normal air temperatures) occurred on Sturmer Pippin, and appeared to decrease with an increase of temperature, but was unaffected by the presence of carbon dioxide in the storage atmosphere.

Eaves (C. A.). **Physiology of Apples in artificial atmospheres.**—*Sci. Agric.*, xviii, 6, pp. 315–338, 10 figs., 5 graphs, 1938.

A tabulated account is given of experiments in 1935–6 to determine the effect on the physiological activities and disorders of apples (mainly McIntosh, Cox's Orange, and Golden Russet) of storage in atmospheres adjusted to contain varying concentrations of oxygen, carbon dioxide, and nitrogen [see preceding abstract]. From the purely phytopathological standpoint the results showed that at temperatures of 3° to 4·5° C. the invasion (as gauged by the total amount of fruit decay in three months' storage) of the apples by rotting fungi, represented almost entirely in these experiments by *Penicillium expansum*, was considerably

retarded by 10 per cent. carbon dioxide, and to a lesser extent by low (2·5 per cent.) oxygen content. These atmospheres also retarded the growth and sporulation of pure cultures of *P. expansum*. In Cox's Orange apples the onset of functional disorders was induced by increased carbon dioxide concentrations, the breakdown in the 2·5 and 5 per cent. carbon dioxide series being of the 'mealy breakdown' type [ibid., xvii, p. 399]; at the lower concentration the trouble was confined to the peripheral tissues, whereas at the higher it affected rather more the vascular areas. In the apples stored in 10 per cent. carbon dioxide the disintegration of the tissues was more or less limited to the core area, including the 10 main vascular bundles, and was of the 'brown heart' type. The breakdown which occurred in McIntosh and Stark apples stored in 100 per cent. nitrogen was characterized by the development in the cortical region of scattered light brown patches, at first well defined but gradually merging into a band-like area of soft tissue, approximately 0·5 cm. below the epidermis. In advanced stages of development the healthy subepidermal tissue gradually breaks down, followed by external browning of the apple skin and final decay of the entire fruit. Golden Russet apples developed superficial scald when stored for prolonged periods in carbon dioxide.

Fruits affected with physiological disorders were found to be characterized by a high rate of respiration, high rate of moisture loss, low acid content, low total solids, low osmotic pressures, and increased permeability to water and electrolytes.

Holz (W.). **Versuche zur Bekämpfung der Perithezien von Fusicladium dendriticum (Wallr.) Fckl. mittels Kalkstickstoff.** [Experiments on the destruction of the perithecia of *Fusicladium dendriticum* (Wallr.) Fckl by means of calcium cyanamide.]—*Zbl. Bakt.*, Abt. 2, xcvii, 23–26, pp. 466–469, 1938.

Details are given of laboratory experiments at the Stade (Schleswig-Holstein] branch of the Biological Institute in which apple leaves bearing perithecia of *Venturia inaequalis* [*R.A.M.*, xvi, p. 469] were placed in flower pots and treated with unoiled calcium cyanamide at the rates of 10, 20, 50, 100, and 200 gm. per pot on 13th December, 1936. On 2nd April, 1937, perithecial development was found to have been entirely checked in the treated pots, whereas in a control pot containing untreated leaves 80 to 95 per cent. of the perithecia were filled with ascospores. The minimum rate of 10 gm. per pot (surface area, 515 sq. cm.) would correspond to about 20 kg. calcium cyanamide per 100 sq. m., a rate somewhat too high for the avoidance of over manuring with nitrogen, and further tests to determine the efficacy of lower doses must therefore be carried out. Satisfactory results were also obtained by strewing calcium cyanamide over the leaves, which were left to overwinter in the open, and by mixing the leaves with calcium cyanamide and making the whole into a compost heap.

Küthe (K.). **Neuere Ergebnisse der Fusikladium-Forschung.** [Recent results of *Fusicladium* research.]—*Angew. Bot.*, xix, 6, pp. 561–566, 2 diags., 1938.

After concisely summarizing the results of recent studies showing

the diversity of physiologic races comprised not only within apple and pear scab (*Venturia inaequalis* [see preceding abstract] and *V. pirina* [see below, p. 466]), but also within other species of *Venturia* [ibid., xvi, p. 618], the writer briefly describes his investigations in eastern Germany to determine the relation of seasonal conditions to apple scab infection and its control.

In the experimental region the critical period for outbreaks of the disease falls in the last few days of April, following abundant ascospore development, which is also no doubt largely responsible for subsequent attacks during early May. Not until the middle of May do the conidia of *V. inaequalis* begin to play an important part in the dissemination of infection, which persists throughout the late summer. Only preventive sprays (on 18th and 24th April) of Bordeaux mixture were of any avail against a scab outbreak on the 25th and 26th, the later being the more effective of the two; a subsequent application on 2nd May was quite useless, the fungicide being unable to reach the fungus within the foliar tissues.

Manns (T. F.), Adams (J. F.), & Heuberger (J. W.). **New spray combinations and new spray materials used on Apples in 1937.**—*Trans. Peninsula hort. Soc.*, xxvii, 5, pp. 51–54, 1937.

The authors describe the results [which are tabulated] of several years' tests of new spray combinations made with the object of finding safer and more efficient fungicides for use against apple diseases. Lime-sulphur combined with wettable sulphur was found to control scab [*Venturia inaequalis*: *R.A.M.*, xvi, p. 477; xvii, p. 118] on susceptible varieties such as Paragon and Stayman approximately as effectively as the copper sprays and with very much less russeting. In the control of fruit spot [*Phoma pomi*: ibid., xvi, p. 764], bitter rot [*Glomerella cingulata*: xvii, p. 121], and black rot [*Physalospora obtusa*: xvii, pp. 45, 121] little difference was found between the lime-sulphur and the copper and sulphur combinations. Fruit with a finer finish resulted from combinations with wettable sulphur and also from treatment with lime-sulphur followed after the first cover spray by an application of 2–4–100 Bordeaux mixture. The application of the copper compounds alone or in combination was not safe till after petal fall, or on some varieties until the second cover spray.

Wilcox (J. C.). **Effects of some field plot treatments on drought spot and corky core of the Apple.**—*Sci. Agric.*, xviii, 6, pp. 300–314, 2 figs., 7 graphs, 1938.

Experiments in progress since 1931 at Kelowna, British Columbia, on the effect of various treatments on the development of drought spot and corky core [internal cork] have already shown that these disorders are due to boron deficiency [*R.A.M.*, xvi, p. 686; xvii, p. 119, and above, p. 462]. Where the trees have not been treated with boron, the intensity of the disorders has been influenced by other treatments and details of these results are given in this paper. Insufficient irrigation was found to decrease the vigour of the apple trees, increase drought spot, and markedly increase corky core. Heavy annual applications of sulphate of ammonia induced a more vigorous growth and more severe drought spot; similar applications of superphosphate had little effect on tree

vigour but appeared to increase drought spot slightly. Tree vigour was not apparently affected by heavy applications of muriate of potash, which lessened the severity of drought spot. No measurable effect was exerted on the severity of drought spot by pruning, while tree crowding lessened both the disease and tree vigour. Statistically valid negative correlations were observed between drought spot and percentage bloom, and positive correlations between drought spot and tree vigour. These results would indicate that, under the conditions of the tests, the severity of drought spot was associated not merely with tree vigour as such, but rather more specifically with the supply of nitrogen.

COLHOUN (J.). **Fungi causing rots of Apple fruits in storage in Northern Ireland.**—*Ann. appl. Biol.*, xxv, 1, pp. 88–99, 1938.

As a result of investigations in 1934–5 in the more important apple-growing districts of Northern Ireland, over 40 species and strains of fungi were isolated from decaying apples in storage at various orchards, and 16 of these species [which are listed] were experimentally shown to be pathogenic to Bramley's Seedling apples, the main variety grown in the region studied. A large proportion of the rots observed had developed around wounds or the stalk or calyx end of the fruit. Rots radiating from lenticels were comparatively few until the storage was far advanced, and little attention was paid to them. In giving a brief account of pathogenicity tests of the more important pathogens, it is stated that there is evidence that *Phytophthora syringae* [*R.A.M.*, xvi, p. 366] may, under certain circumstances, be of some economic significance in Northern Ireland. Of the two species of *Mucor* isolated, *M. racemosus* was more common than *M. piriformis*, and both rank among the four most important diseases of stored apples in the country. *Penicillium expansum* appeared to be widespread and is the most serious source of damage to apples in storage, another important fungus being *Phoma mali*. *Phomopsis mali* (the pycnidial stage of *Diaporthe perniciosa*) was the dominant species causing rots from Christmas onwards. *Corticium centrifugum* [ibid., xiv, p. 701] was found in only one orchard on a few apples, and the rot caused by it is stated to be essentially a late storage trouble. Other records include *Cytosporella mali* (isolated three times), *Gloeosporium fructigenum* [*Glomerella cingulata*] (once), *Colletotrichum gloeosporioides* (twice), *Fusarium lateritium* var. *fructigenum* [*F. lateritium*] (once) [ibid., xvi, p. 688], and *F. avenaceum* (five times) [ibid., xvi, p. 756].

A brief reference is made to the work of other authors indicating that the main source of storage rots may be traced back to the orchard, and greater care is therefore recommended both in general orchard management and in the handling of the fruit at and after picking; it should not be left lying on the ground in the orchard after collection.

CHEAL (W. F.) & DILLON WESTON (W. A. R.). **Observations on Pear scab (Venturia pirina Aderh.).**—*Ann. appl. Biol.*, xxv, 1, pp. 206–208, 1 pl., 1938.

Observations at Cambridge in 1936 to determine more precisely the time at which pear trees in the spring are infected with scab (*Venturia pirina*) [*R.A.M.*, xiii, p. 245; xvii, p. 328] showed that on a tree with

infected wood, many of the buds after rain showers were literally bathed in spore suspensions of the fungus, and that when the water evaporated the conidia remained on the bud scales or slightly drawn up amongst the leaves and flowers of developing buds. That infection resulted in this way was confirmed by the fact that the under surfaces of the leaves and the calyces on that tree were the first to become infected. Further observations on Conference pear trees at Tydd Gote, Pitmaston Duchesse at Wilburton, Doyenne du Comice at Wilburton, and an unknown variety at Girton, Cambridge, showed the presence on them of pear scab pustules on the edges of a large number of cankers on four-, five-, six-, seven-, and eight-year-old wood, indicating that in some cases, as yet not definitely explained, the fungus may evade the cork barrier and become perennial. It is suggested that these findings stress the importance of pre-blossom fungicide sprays and the necessity of spraying pear-trees over a much longer period in the season than is required for apples.

JØRSTAD (I.). **Melding om plantesykdommer i land- og hagebruket. Sprøiteforsøk mot soppsykdommer på frukttraer.** [Report on plant diseases in agriculture and horticulture. Spraying experiments against fungous diseases of fruit trees.]—61 pp., Oslo, Grøndahl & Søns Boktrykkeri, 1937. [Received May, 1938.]

Further extensive details are given of official experiments in Norway in the control of apple scab [*Venturia inaequalis*: cf. *R.A.M.*, xi, p. 49] and other fruit diseases from 1931 to 1936. No conclusive evidence of the superiority of Bordeaux mixture over lime-sulphur was forthcoming in the scab trials, the greater toxicity of the former, in the few cases in which it was demonstrated, being more than outweighed by its tendency to scorch the trees. Probably the most effective schedule consists of an early application of Bordeaux mixture (between the unfolding of the buds and blossoming), followed by three treatments with lime-sulphur.

In a four-year experiment against apple canker [*Nectria galligena*] on the Åkerø, Gravenstein, and Signe Tillisch varieties, a combined Bordeaux–lime-sulphur schedule also gave good control, the regular programme being supplemented by an application of 4 per cent. copper sulphate immediately before the unfolding of the buds.

In severe outbreaks of apple mildew [*Podosphaera leucotricha*] on Gravensteins four fungicidal treatments are required, the first to be applied during the unfolding of the overwintered buds. Very satisfactory control was given both by lime-sulphur plus a spreader of 0·5 per cent. wheat flour and by solbardo (Bayer sulphur dust).

As a rule the standard schedule (ordinary or 'white' Bordeaux mixture decreasing from 1 to 0·5 per cent.) gave excellent control of pear scab [*V. pirina*: see preceding abstract], the first treatment being given immediately before the blossom, the second just after, and the third during the green fruit stage.

Empress pears suffering severely from canker [*N. galligena*] recovered to an appreciable extent as a result of regular treatment with Bordeaux mixture from 1929 to 1936, supplemented in 1933–4 by a dormant application of 3 per cent. copper sulphate.

Plum pocket disease [*Taphrina pruni*: ibid., xvi, p. 330] was well controlled on the Rivers' Early Prolific variety by a dormant application of 2 per cent. copper sulphate followed by 1 per cent. Bordeaux mixture just before blossoming, while almost equally good results were obtained with lime-sulphur at the same times (winter strength for the first).

Shot hole of peaches [*Clasterosporium carpophilum*: ibid., xvii, p. 257] was successfully treated with one or two applications of Bordeaux mixture at a strength of 1 per cent. before and 0·5 per cent. after blossoming. A supplementary application, immediately before the unfolding of the buds, of 1 per cent. sodium hydroxide with green soap was effectual against *Monilia* [? *Sclerotinia laxa*].

In a concluding section notes are given on various proprietary substances included in the foregoing trials. Hovdes mildew wash (A/S Torp Bruk, Frederikstad) proved very effective against *P. leucotricha* on apple. Bayer Kupferkalk and Kupferkalk Ob. 21 both gave good control of apple and pear scab but tended to cause scorching, the former on apple only, the latter on both fruits. Bordinette (Cooper, McDougall & Robertson, Ltd., Berkhamsted, Herts., England) and nosprasit (Farbenindustrie, Leverkusen) also proved effective against both apple and pear scab. Bouisol was also effective against the former. Alvesco soluble spreader (Murphy Chemical Co., Ltd., Wheathampstead, Herts., England), spreadite (Murphy), and household gelatine were valuable adjuncts to the various brands of lime-sulphur used in the experiments.

Tindale (G. B.), Trout (S. A.) & Huelin (F. E.). **Investigations on the storage, ripening, and respiration of Pears.**—*J. Dep. Agric. Vict.*, xxxvi, 2, pp. 90–104, 2 figs., 9 graphs, 1938.

In this fully tabulated account of investigations carried out in Victoria into the storage, ripening, and respiration of pears [cf. *R.A.M.*, xiv, p. 373] the authors state that when pears are ripened after a short period in cool storage, the flesh becomes very soft in the over-ripe condition, with a slight grey discoloration, and the skin is usually infected by moulds [unspecified]. The condition is not localized, and suggests general, not core, breakdown. When removed after longer periods of cool storage, pears develop scald or core breakdown [ibid., xiii, pp. 246, 709] in the over-ripe stage. Similar disorders are associated with over-storage, but with this difference, that over-stored pears are devoid of flavour and juice. In over-ripe pears scald and breakdown occur after normal ripening, the pears remaining very soft and juicy. The time at which the disorders of over-ripeness occur depends on the treatment given before ripening. Thus, pears stored at 37° F. for 4, 5, 6, and 7 weeks developed, respectively, 8, 40, 63, and 100 per cent. core breakdown after 7 days at 65°, and others stored at 32° for 6, 8, 10, and 12 weeks developed, respectively, 10, 20, 49, and 86 per cent. core breakdown after 12 days at 65°.

When seven varieties of pears were stored for eight weeks at 34° in atmospheres containing 5, 10, 15, and 25 per cent. carbon dioxide and then ripened at 65°, brown heart injury [ibid., iii, p. 144; cf. above, p. 443] generally appeared when the concentration of carbon dioxide reached 10 per cent., maximum increase in storage life being given by one of 5 per cent. Varieties free from brown heart ripened satisfactorily after

exposure to concentrations of up to 15 per cent., but a fermented taste usually resulted when the carbon dioxide was allowed to accumulate up to 25 per cent.

Significantly more core breakdown occurred in wrapped pears ripened in standard cases in a continuous current of air at 65° than in those ripened in trays under the same conditions, but pears ripened in flat cases showed no significant difference in this respect. In standard cases there was more core breakdown in the inner than in the outer fruits, and retailers are advised to dispose of the inner fruits first.

Pears destined for export should be picked while in a hard, green condition, pre-cooled as soon as possible, and transported overseas at 31° to 32°.

Report of the Low Temperature Research Laboratory, Capetown, 1935–1936.—215 pp., 15 pl., 4 diags., 21 graphs, 1937. [Received April, 1938.]

During the 1935–6 season investigations were continued by R. Davies and W. W. Boyes (pp. 69–129) into the internal breakdown of Japanese varieties of plums (Santa Rosa, Wickson, Gaviota, Kelsey, and several others) grown in the Western Cape Province [*R.A.M.*, xvii, p. 255]. The disorder was restricted to storage temperatures of 31° F. and 45° or occasionally 29° for a storage period of 25 days. The following general conclusions can be drawn from the investigations carried out in this and the preceding two seasons. Storage at 50° allows full ripening in a fairly normal manner. Fruit stored at 45° ripens normally when picked at the more advanced stages of maturity, but showed slight varietal differences in behaviour. Gradual reduction of temperature from 45° to 40° or 37° gives a progressive increase of breakdown, while still further reduction from 37° to 31° shows a progressive decrease, resulting generally in absence of breakdown at 31°, when the storage period is limited to 25 days. Breakdown occurs soonest at the highest temperature at which it occurs, appearing with decreasing rapidity at the following temperatures: 45°, 40°, 37°, 34°, and 31°. The effect of maturity at picking on susceptibility to breakdown is very erratic at all temperatures. The various types of the injury which the authors include under the general term 'internal breakdown' are injection, severe discoloration with radiating cavities, bladderiness, a white ring of dry, spongy tissue, general brownish blush of the flesh, scald, and aeration of the flesh, the two first-named being the most common forms. The gross appearance of the tissues differs considerably with the various combinations of storage and ripening temperatures, maturity, and the length of storage period. Injection of the flesh is encountered in fruit stored for short periods at 31° to 45° and ripened at 65° and could be easily mistaken for the normal over-ripe stage but for the lack of free juice. Severe discoloration with radiating cavities occurs in the fruit which fails to ripen at a post-storage temperature of 45°. It is suggested that for export the plum varieties should be divided into at least two groups, one group being shipped at about 45°, the other either at 31° or about 45°; for the latter group the maturity at picking must be adjusted to the temperature. Accordingly the temperature of ships' chambers should be either raised to 45° or lowered to 31°.

The investigations by R. Davies, H. H. Boyes, and D. T. R. de Villiers (pp. 130–160) on woolliness of peaches developing in cold storage were carried out on the varieties Inkoos, Duke of York, Cape Treestone, Peregrine, Pucelle, and Elberta at storage temperatures of 31°, 34°, 37° and occasionally 29° and 45°, for periods of 10, 17, 24, and 31 days. The breakdown of stored peaches occurring in other countries [ibid., xiv, p. 773] is thought to be identical with the condition known as woolliness in South Africa. Both abnormalities occur much sooner at 37° than at 31° to 32°, and the similarity to internal breakdown of Japanese varieties of plums [see above, p. 469] is very striking. The time required for woolliness to appear depends on the susceptibility and maturity of the fruit. Fruit stored for a short period ripened normally on removal, showing an even creamy texture, much juice, and good aroma and flavour. With the increase of storage period the juice dried out and the flesh became first mushy and slimy, slightly stringy, later spongy with slight general browning, and ultimately coarse with large areas next to the stone severely discoloured and injected. In an advanced stage the fruit when broken by hand resembles a ball of wool; a normal fruit at a certain degree of maturity may, however, look very similar. After 24 days of storage, fruit in the A [early], B [intermediate], and C [late] stages of maturity showed no woolliness at 31°, 100, 47, and 2 per cent., respectively, at 34°, and 100, 45, and 1 per cent., respectively, at 37°. Some evidence is available that woolliness does not occur in Late Crawford peaches stored for 24 days at 45°, is severe at 37°, and absent at 31° even after 31 days of storage. A delay of storage of 48 hours eliminated woolliness in four of six consignments, and a delay of 72 hours was effective in practically all cases. Pre-cooling of the fruit gave almost no advantage. Fruit from a tree affected by 'delayed foliation' and fruit from a normal tree showed, respectively, 100 per cent. and less than 50 per cent. woolliness when stored for 24 hours at 34°.

J. M. Rattray (pp. 167–187) points out that grapes in the greener stages of maturity appeared to be more resistant to wastage, due to *Botrytis* [*cinerea*: ibid., xvii, p. 373], during the season under observation, whereas in the previous season the riper stages showed more resistance. Contrary to last season's results condensation water, which may form when grapes are moved from a cold to a warmer temperature, appeared to promote the germination of *Botrytis* spores and increase infection. Under favourable humidity conditions in cold store *Botrytis* develops freely at 34°F. The time that must elapse before picking grapes after rain has not yet been determined, but outbreaks of *Botrytis* usually occurred in the vineyard within three days after the rain. A wrapper with a low degree of porosity like the 'crystalline' paper used in the experiments is not recommended in seasons of possible *Botrytis* development, as it maintains high humidity conditions in and around the bunch, which, although producing the freshest condition of the grapes, is usually coupled with high wastage. The best results in reducing *Botrytis* wastage were obtained by inserting crêpe paper plugs treated with a 0·5 N solution of iodine into the bunches and using 'crystalline' paper wrappers. Iodized wrappers were more effective when enclosed in 'crystalline' paper. As little handling as possible of

the Raisin Blanc grapes before storage improved their condition after storage. In conformity with last year's results *Botrytis* invariably developed in bunches from which infected berries had been removed. Four per cent. formalin sprayed on to the lining of the boxes had little effect, whereas dusting of bunches with brassisan [ibid., xv, p. 196] prior to packing appeared to be effective when it was applied in large quantities. Irrigated and non-irrigated consignments showed no significant differences in the development of *Botrytis* wastage.

E. Beyers (pp. 187–199) gives further data on 'drop berry' of grapes [ibid., xvi, p. 620] confirming the view that atmospheric conditions and soil moisture before harvesting mainly determined the susceptibility of Waltham Cross grapes to drop at Paarl. Air temperature and humidity during picking and packing may also have some effect. Picking in the morning is preferable to afternoon picking. Direct packing showed little improvement in comparison with 24 hours' delay, but delay of more than 36 hours increased dropping considerably and was detrimental to the quality. Grapes picked at a riper stage than the commercial appeared to be slightly less susceptible to drop. The use of waxed cystalline wrappers resulted in 91 per cent. green stalks and 3·3 per cent. drop as compared with 42 per cent. green stalks and 5·6 per cent. drop for the ordinary sulphite wrapper.

Experiments on the effects of maleic acid on unripe fruit similar to those of Copisarow [ibid., xvi, p. 396] are described by W. E. Isaacs (pp. 199–215). The capacity of maleic acid to retard the ripening of fruit is confirmed, but attention is drawn to the resulting skin injuries. The Pearmain apples treated with amyl acetate alone or with maleic acid and amyl acetate showed more susceptibility to fungal attack in store at 65° and 45° than the controls.

Manns (T. F.) & Heuberger (J. W.). **Some problems in the dissemination of bacterial spot of Peach.**—*Trans. Peninsula hort. Soc.*, xxvii, 5, pp. 57–62, 2 figs., 1937.

A very severe outbreak of the bacterial fruit spot of peach (*Bacterium pruni*) [*R.A.M.*, xvii, p. 256], favoured by high humidity and excessive rainfall during the 1937 season, is reported from the Peninsula, Delaware. The varieties J. H. Hale, White Hale, and Elberta were attacked to the extent of 75 to 80 per cent., and three- to four-year-old trees just coming into bearing were those most severely affected; they showed much fruit blotching and spotting and considerable foliar shot hole, but only slight defoliation, which was more severe in six- to eight-year-old trees (possibly due to spray injury). Observations on one-, two-, and three-year-old trees showed that their foliage was much affected by shot hole though very little defoliation had taken place. Fruit from the younger trees showed 75 to 80 per cent. infection as compared with 10 to 25 per cent. in that from older trees. According to the standard spray programme followed in the Peninsula no fungicide is applied to the trees during the first three years of growth, and this accounts for the failure of the routine sprays to control the outbreak of the disease. Culturing on an artificial medium showed that from 10 to 80 per cent. of the buds were carrying infection, although they showed no external signs of it. Examination of the budding stock from several nurseries

proved that they carry much infection. The thermal death point of *Bact. pruni* being 51° C. for 10 minutes, an attempt was made to control the disease with hot-water treatment, which was, however, unsuccessful, because of the injury to the tree, nearly all the buds being killed on exposure to 53° for 15 minutes. Infected nursery stock set in the field in November, 1936, carried the infection through the following summer, whereas the same stock planted and grown in the greenhouse from December, 1936, to November, 1937, was found not to carry any infection in the buds. *Bact. pruni* is known not to thrive in arid regions, and it is therefore advised that August-budded trees be shifted to such regions and taken back later on to be used as budding material.

VIDAL (J. L.). **A propos du traitement contre la chlorose calcaire des arbres fruitiers.** [On the treatment of lime-induced chlorosis of fruit trees.]—*C. R. Acad. Agric. Fr.*, cxxiv, 5, pp. 159–164, 1938.

An account (preceded and followed by some pertinent observations by P. Gervais) is given of the writer's completely successful experiments in France on the control of lime-induced chlorosis of the rose [*R.A.M.*, xii, p. 373] and peach [ibid., xv, p. 515]. One of the small roots of a chlorotic rose-bush was immersed on 17th September, 1937, in a flask of 0·75 l. capacity filled with a solution of 20 gm. citric acid. Within a week the condition of the plant improved and by 3rd October it was completely cured. The citric acid had evidently released and rendered soluble the iron in the plant without any supplementary addition of iron to the solution. Chlorosis in peaches was remedied by a similar treatment with the admixture of 100 (or up to 130) mg. iron sulphate in a solution of 20 gm. citric acid and 1,000 gm. water. Signs of recovery began to be noticeable ten days after the commencement of the experiment and the renewal of the normal green coloration proceeded thenceforth with increasing rapidity.

CARNEIRO (J. G.). **A secca das pontas dos galhos do Pecegueiro.** [Die-back of Peach twigs.]—*Biologico*, iv, 1, pp. 18–19, 1938.

In this note the author records [without further details] the first known discovery of *Phoma persicae* [*R.A.M.*, xv, p. 745] on peaches in Brazil, a very brief account of which is given from the literature. For its control he recommends the careful elimination of all dry wood during the winter pruning of the trees, dormant spraying with 2 per cent. Bordeaux, and weekly or fortnightly spraying with 1 per cent. Bordeaux during vegetation. After pruning all infected material should be immediately burnt.

THOMAS (P. H.). **Notes on Apricot 'dieback'. Circumvention by propagative methods.**—*Tasm. J. Agric.*, N.S., ix, 1, pp. 46–49, 3 figs., 1938.

Considerable loss is caused to growers every year throughout the chief apricot areas of Tasmania and in some parts of the mainland of Australia by a die-back [*R.A.M.*, xi, pp. 311, 792] which causes spurs, branches, and entire trees to die off. The cause of the condition has not yet been definitely ascertained, but field observations over a wide area in Tasmania showed that while apricot trees on apricot stock are, as a

rule, completely killed when affected, in apricots worked on cherry plum stocks the disease appears to stop at the graft union, large numbers of strong young plum suckers being produced below. Trials in which selected suckers arising from the roots of diseased trees were worked with apricot grafts and buds at a height of 3 ft. have given highly encouraging results, such rejuvenated trees being unaffected after six years. There would appear to be some evidence that the Moorpark apricot variety is more susceptible to the die-back than other varieties grown in Tasmania.

ZELLER (S. M.). **Dwarf disease of the Loganberry.**—*Bett. Fruit*, xxxii, 8, p. 18, 1938.

Though the losses caused by loganberry dwarf disease [cf. *R.A.M.*, vii, p. 183] in the Pacific coast area of the United States are only very slight on the whole, individual growers and certain localities have sustained very heavy losses from the condition. At present, there are two infection areas in Oregon, one situated in western Marion and eastern Polk county, and the other in north-eastern Benton county. In these parts the affected plantings show 2 to 95 per cent. dwarf. Some plantings in the same areas are still unaffected, but the infected plants in the vicinity constitute a source of danger. Roguing is practicable when under 5 per cent. infection is present, and must be thorough, and the affected plants should be burnt immediately.

WARD (F. S.). **Cercospora leaf spot of Bananas.**—*J. Jamaica agric. Soc.*, xlii, 1–2, pp. 23–34, 6 figs., 1938.

In Jamaica, banana leaf spot (*Cercospora musae*) [*R.A.M.*, xvii, p. 375] has only occasionally caused severe damage, and very little injury to the fruit has resulted. The disease has often developed in its worst form in the more recently developed lands, many of which are in some respects not entirely suitable for bananas, and especially in districts which under normal circumstances and even in the absence of the disease produce considerable quantities of inferior fruit. Severe damage has not been sustained in first-class banana lands.

In five months' spraying tests the best control was given by applications at intervals of three weeks of 1 per cent. I.C.I. compound (cuprous oxide) applied at the rate of 250 galls. per acre. Similar applications at fortnightly intervals did not give better control. Applications at intervals of three weeks at concentrations of $\frac{1}{2}$ or 1 per cent., and using 200 to 250 and 150 galls. per acre, respectively, also gave a considerable degree of control. Satisfactory results did not, however, follow applications of $\frac{1}{4}$ per cent. concentration, at the rate of 100 to 250 galls. per acre, at 3-week intervals, or of 1 per cent., at the rate of 250 galls. per acre, at 6-week intervals.

Bordeaux mixture (4–4–40) applied at 3-week intervals (200 to 250 galls. per acre) imparted a better appearance to the foliage than the same treatment at half strength, but the weaker concentration gave better filled fruit; applications at full strength at 6-week intervals (250 galls. per acre) did not give satisfactory control. Preliminary fruit-weighing records indicate definitely that a better grade of fruit is obtained by spraying with the I.C.I. compound than with Bordeaux

mixture. Dusting experiments so far as they have gone indicate that there is no appreciable difference in the degree of control given by I.C.I. and Bordeaux mixture dusts, both being satisfactory when judiciously applied. Bordeaux dust should be applied at the rate of 40 lb. per acre and at least six dustings per annum are recommended.

The variety S.19 (a cross between two varieties of *Musa sapientum*) appears to be virtually immune from the disease, though commercially unsuitable.

[This paper also appears as *Bull.* 15, *Dep. Sci. Agric. Jamaica.*]

DUTTON (W. C.). **The seriousness of spray injury.**—*Trans. Peninsula hort. Soc.*, xxvii, 5, pp. 46–50, 1937.

Observations over many years in Delaware have shown that spraying with lime-sulphur is the cause of severe injuries to apple trees [*R.A.M.*, xvii, p. 119] such as leaf-burn, stunting and dwarfing of early leaves, and leaf-fall, mainly of small basal leaves, which impairs the fruit set and the formation of buds in the succeeding season. Arsenicals combined with lime-sulphur also cause serious leaf-fall. In one instance the treatment of 2- to 3-year-old and older trees with lime-sulphur resulted in the formation of 20 and 7 per cent. spurs with fruit, respectively, compared with 46 and 20 per cent. in control trees treated with a non-injurious material. In another instance Jonathan and Hubbardston apple-trees sprayed with lime-sulphur lost 69 per cent. of their leaves as compared with 17 per cent. in the controls. The following spring Jonathan showed 14 per cent. and Hubbardston 22 per cent. spurs with blossoms compared with 51 and 48 per cent. in the controls. In an experiment on Baldwin trees the total of the annual yields per tree from the third to the seventh year, inclusive, of trees treated with lime-sulphur was 1,705 lb. compared with 3,225 lb. in the control. The injuries increased with the increase of the concentration of lime-sulphur and with over-spraying. Injury was greatest in moist, cold, and sunless seasons, the tender and succulent type of leaf then developing being very susceptible to injury.

BUTLER (O. R.). **Lime-sulphur spray injury.**—Reprinted from *J.N.H. hort. Soc.*, ii, 2, pp. 121–128, 1938.

Preliminary studies on the effects of spraying beans [? *Phaseolus vulgaris*] with lime-sulphur solution with and without added acid lead arsenate and calcium arsenate showed that beans respond to lime-sulphur spraying in a similar way to apples. The margin of the young expanding leaves becomes stunted or is killed outright, and the leaves become convex and distorted. Fully expanded leaves remain uninjured. When beans were grown for 79 days at a mean temperature of 66·7° F. and sprayed six times with lime-sulphur (1 in 50) the mean dry weight of the sprayed plants was 71·68 per cent. of that of the unsprayed, the corresponding figure for the fruit alone being 71·46 per cent. Substantial injury was caused by the spraying, but the physiological balance was undisturbed, and the relative development of the fruit and foliage in both series was the same; loss of yield is proportional to foliage injury. When other beans were grown for 91 days at mean temperatures of 66·2° and 56·4° and sprayed eight times with the same

solution the dry weight of the sprayed plants grown at the higher and lower temperatures was, respectively, 83·7 and 72·7 per cent. of that of the unsprayed controls. A test of the loss of weight produced by spraying four to eight times indicated that lime-sulphur spraying does not cause cumulative injury.

When sprayed beans were divided into two lots, one of which was exposed to dew and rain, weathering did not increase the spray injury. When, however, acid lead arsenate or calcium arsenate was added to the spray solution, weathering markedly increased spray injury.

Spray injury was not reduced by diluting the lime-sulphur to 1 in 100 and 1 in 200, but it was found that when cane sugar is added to lime-sulphur solution the sulphides are unaffected, and the solution decomposes more slowly on drying. Osmotic pressure is increased, and penetration of the leaf between application and drying (the period when injury is produced) is impeded. Injury was reduced by between 10 and 30 per cent. when cane sugar was added at the rate of 1 per cent. This beneficial action of sugar was valueless, however, when acid lead arsenate or calcium arsenate was included in the spray.

ERVEN (H.). **Die Bodendämpfung. Eine neue und wichtige Massnahme für die Landwirtschaft und den Gemüsebau. Die erste Bodendämpfungsgenossenschaft bereits gegründet.** [Soil-steaming. A new and important practice in agriculture and vegetable cultivation. The first co-operative soil-steaming society already founded.]—*Dtsch. landw. Pr.*, lxv, 7, p. 79; 8, p. 94, 4 figs., 1938.

This is a concise survey of the advantages of soil-steaming [*R.A.M.*, xvii, p. 194] over chemical and cultural methods of sterilization against eelworms and other injurious micro-organisms liable to attack agricultural and market-garden crops in Germany. A technical description is given of the Lerch soil-steaming apparatus, consisting of a portable steam boiler with pipes leading to a soil cover inside the greenhouse; details are given of its mode of application, and of the costs involved in the treatment of the soil by this method. The writer has already introduced the co-operative method of soil disinfection into the Rhine Province and foresees its rapid extension throughout the country.

GRANOVSKY (A. A.), KUNKEL (L. O.), LEACH (J. G.), & POOS (F. W.). **Symposium of the relationship between insects and plant diseases.**—*J. econ. Ent.*, xxxi, 1, pp. 11–39, 1938.

This is a review of contemporary studies on the relationship between insects and diseases of (1) truck crops (A. A. Granovsky, with discussion by D. M. De Long), (2) fruit trees and small fruits (L. O. Kunkel, with discussion by E. M. Searls), (3) shade and forest trees (J. G. Leach), and (4) cereal and forage crops (F. W. Poos, with discussion by J. W. Ingram). Notices of most of the work referred to have appeared from time to time in this *Review*.

TEMPLE (C. E.). **Disease resistance in horticultural crops.**—*Trans. Peninsula hort. Soc.*, xxvii, 5, pp. 150–158, 1937.

The author gives a general account of the work carried out and in progress at several experiment stations in the United States,

particularly Maryland, on the breeding of disease-resistant varieties of horticultural crops, including peas, potatoes, cucumbers, spinach, and watermelons.

Roemer (T.), Fuchs (W. H.), & Isenbeck (K.). **Die Züchtung resistenter Rassen der Kulturpflanzen.** [The breeding of resistant races of cultivated plants.]—*Kühn-Arch.*, xlv, 427 pp., 2 col. pl., 35 figs., 4 diags., 2 graphs, 1938.

This volume (the 13th of the *Kühn-Archiv* devoted exclusively to plant breeding) comprises copiously annotated and tabulated sections (each followed by a bibliography of the relevant literature) on the necessity of breeding disease-resistant varieties; the biological foundations of breeding for resistance; the nature of resistance; the inheritance of resistance; the organization of breeding for resistance; together with detailed discussions (constituting the bulk of the volume) of a number of major diseases to be combated by the development of resistant selections, the diseases being treated with particular reference to the biology, mode of infection, and specialization of the causal organisms, varietal reaction of the host, and breeding. Most of the more recent work mentioned has been noticed from time to time in this *Review*.

Drechsler (C.). **Two Hyphomycetes parasitic on oospores of root-rotting Oomycetes.**—*Phytopathology*, xxviii, 2, pp. 81–103, 5 figs., 1938.

One of the two Moniliaceous fungi constantly occurring as vigorous parasites on the oospores and other organs of Pythiaceous root-rotting organisms in culture is identified on the basis of its mostly triradiate and cruciform conidia as *Trinacrium subtile*, while the other, characterized by predominantly triseptate, hyaline, elongate-fusoid, *Fusarium*-like conidia, 35 to 65 by 3·8 to 5·2 μ (mean 50 by 4·5 μ) is described [with Latin and English diagnoses] as *Dactylella spermatophaga* n.sp. Notwithstanding marked differences in conidial design, the two organisms under discussion seem to be closely related taxonomically, both apparently belonging to the predacious series of Hyphomycetes, represented, e.g., by *D. passalopaga* and *D. leptospora* [*R.A.M.*, xvii, p. 36].

Among the *Pythium* spp. attacked by *D. spermatophaga* in the writer's laboratory were *P. arrhenomanes* [ibid., xvii, p. 204], *P. butleri*, *P. de Baryanum*, *P. irregulare*, *P. mamillatum* [ibid., xv, p. 109], and *P. ultimum*. Grown in dual culture with other Oomycetes it further abundantly parasitized the oospores of a number of species, including *P. graminicolum* [ibid., xvii, p. 384], *P. myriotylum* [ibid., xiv, p. 473], *P. oedochilum*, *Phytophthora cactorum*, *P. megasperma* [ibid., xvi, p. 292], and *Aphanomyces euteiches*. Infection is accomplished by the successive perforation of the oogonial and oospore walls, followed by the development within the oospore of a branched, somewhat lobate, rather massive haustorium which assimilates the protoplasmic contents. By reason of its evident capacity for widespread destruction of the oospores on which Oomycetes largely depend for their survival from one season to the next, *D. spermatophaga* may well serve as an effective agent of soil sanitation for protracted periods.

T. subtile occurred as a parasite in cultures of *Pythium butleri* isolated from decayed spinach-crowns.

KOTTE (W.). **Die volkswirtschaftliche Bedeutung der Phytopathologie in Südwestdeutschland.** [The national-economic importance of phytopathology in south-west Germany.]—*Angew. Bot.*, xix, 6, pp. 567–573, 1938.

Some interesting observations are made concerning the phytopathological problems of south-west Germany, the peculiarly varied climatic and geological conditions of which, while facilitating the cultivation of a wide diversity of crops, complicate the establishment of uniform plant protection schedules. Among the chief diseases to be combated may be mentioned winter injury to cereals by *Fusarium*, yellow rust of wheat [*Puccinia glumarum*], potato blight (*Phytophthora*) [*infestans*], hop downy mildew (*Peronospora*) [*Pseudoperonospora humuli*], tobacco wildfire (*Pseudomonas* [*Bacterium*] *tabaci*), and vine downy mildew (*Peronospora*) [*Plasmopara viticola*].

BÄRNER (J.). **'Intrazellulare Stäbe' bei viruskranken Solanaceen und Cucurbitaceen.** ['Intracellular cordons' in virus-diseased Solanaceae and Cucurbitaceae.]—*Angew. Bot.*, xix, 6, pp. 553–561, 7 figs., 1937.

The writer's further studies at the Biological Institute, Dahlem, Berlin, on the significance of 'intracellular cordons' in virus-diseased plants [*R.A.M.*, xvi, p. 704] comprised fresh and fixed transverse sections of potato, tobacco, *Datura stramonium*, *Solanum nigrum*, cucumber, melon, and vegetable marrow. The presence of these bodies was shown not to be necessarily correlated with virus infection, many diseased plants being entirely free from them while, conversely, apparently healthy individuals contained large numbers. No diagnostic importance can, therefore, be attached to the presence or absence of 'intracellular cordons' in the study of virus diseases of the Solanaceae and Cucurbitaceae.

JOSHI (N. V.) & DUTT (S. C.). **Studies on the dissociation of Bacillus cereus, an organism associated with plants affected with mosaic disease.**—*Indian J. agric. Sci.*, vii, 5, pp. 763–783, 3 pl., 1937. [Received May, 1938.]

The authors found that an organism tentatively identified as *Bacillus cereus* was practically always present in mosaic-diseased tomato, *Luffa acutangula*, *Momordica charantia*, *Hibiscus esculentus*, and tobacco-plants [cf. *R.A.M.*, xv, p. 315]. Inoculation experiments with this organism gave inconsistent results and no conclusion can be drawn, therefore, as to whether it is the real cause of mosaic disease. In culture the organism dissociated into several variants, details of which are given in full.

GREENHILL (A. W.). **Boron deficiency in horticultural crops: recent developments.**—*Sci. Hort.*, vi, pp. 191–198, 4 pl. (facing pp. 193, 208, 209, and 224), 1938.

In this paper the author briefly summarizes recent developments in

the use of boron with special reference to vegetables and horticultural crops [*R.A.M.*, xvii, p. 63].

Hilitzer (A.). **Pilzerkrankungen und Transpiration.** [Fungous diseases and transpiration.]—*Stud. bot. Čechoslov.*, i, 1, pp. 20–36, 1938.

Enhanced transpiration was a feature of the diseased organs of a number of plants used in the writer's experiments in 1933 at the Prague (Czechoslovakia) Technical College, which involved the accurate measurement, by weighing, of the water-loss in cut leaves. In most cases this phenomenon was found to be primarily due to the rupture of the epidermis (e.g., by the aecidia or uredosori of the rusts), which removed the natural protection afforded by the cuticle. For example, the average loss of water in three *Abies alba* branches infected by *Melampsorella caryophyllacearum* [*R.A.M.*, xvi, p. 350] was 67·4 per cent. of the initial water content, compared with 60·7 per cent. for three healthy branches, while very high figures were also obtained in the case of *Uromyces pisi* on *Euphorbia cyparissias* [ibid., xv, p. 607], and for the following fungi: *Taphrina turgida* and *T. betulae* on birch [ibid., vi, p. 762], *T. pruni* on plum [ibid., xvi, p. 330], *Fusicladium dendriticum* [*Venturia inaequalis*] on apple, and *F.* [*V. pirina*] on pear [ibid., xv, p. 375]. The Peronosporaceae, on the other hand, merely occlude the stomata with their conidiophores without damaging the cuticle and so cause only a slight increase of transpiration. Erysiphaceae gave variable results. The occasional reduction of transpiration in diseased foliage may be due to the protection of the leaf blade by the mycelium, e.g., in the case of *Erysiphe cichoracearum* on *Scorzonera humilis*.

Generally speaking, slight infection has a greater relative effect on the loss of water than heavy infection, while soft, succulent tissues are particularly prone to increased transpiration. Intensive transpiration is a marked characteristic of the early stages of a disease, in the final phase of which, however, the necrotic lesions may give off no water at all.

Taylor (C. F.). **The incidence of yellow dwarf in Potato varieties.**—*Amer. Potato J.*, xv, 2, pp. 37–40, 2 diags., 1938.

In 1935 potatoes planted in a varietal test at Ithaca, New York, developed a considerable incidence of yellow dwarf [*R.A.M.*, xvii, pp. 132, 412] ranging from 1·6 per cent. in the variety U.S.D.A. No. 44537 to 48·4 per cent. in Columbia Russet. In 1936 the latter was the only one of nine varieties to show any trace of the disease (2·4 per cent.). The available evidence does not afford a clear explanation of the fluctuation in the extent of yellow dwarf from one year to the next, but the factor involved is probably either inherent varietal predisposition or 'klendusity', i.e., the operation of some varietal character on the rate of occurrence of infection.

Folsom (D.), Libby (W. C.), Simpson (G. W.), & Wyman (O. L.). **Net necrosis of Potatoes.**—*Bull. Me Coll. Agric. ext. Serv.* 246, 12 pp., 9 figs., 1938.

In this bulletin the authors give brief descriptions [which are well illustrated] of various forms of internal discoloration affecting potato,

including net necrosis (caused by the leaf roll virus) [*R.A.M.*, xvi, pp. 400, 481], freezing injury (sometimes resembling net necrosis but usually accompanied by blotching), heat necrosis, discoloration of fungal origin, such as that due to *Fusarium* or *Verticillium*, and stem-end browning (dark-coloured streaks, ½ to 1 in. long, extending from the stem end, of which the cause is unknown).

MURPHY (P. A.). **Potato virus research and the production of virus-free seed Potatoes.**—*Sci. Hort.*, vi, pp. 215–222, 1938.

In this paper the author states that potato leaf roll [*R.A.M.*, xvii, p. 56] is of negligible importance in Ireland, probably owing to a combination of climatic and cultural conditions. *Myzus persicae* is also very scarce in Ireland, a survey of part of the central plain (N. Tipperary, Offaly, and E. Galway) made on 29th July to 1st August, 1936, showing only 6 out of 15 fields to be infested, and these only to a very limited extent, the numbers present ranging from a trace to 18 per 100 leaves. In northern and eastern Donegal the insect is even rarer.

Potato varieties fall into 4 main groups according to their reaction to the mosaic viruses. Group 1, intolerant of virus X, includes Arran Crest, Epicure, and King Edward VII. These never show simple mosaic (X virus) [ibid., xvi, p. 337 *et passim*], interveinal mosaic (X+F), crinkle (X+A), or rugose mosaic (X+Y); any faint mosaic (as in Arran Crest) is due to Y or A virus. Group 2 (Alannal, Arran Peak, British Queen, Dunbar Standard, Great Scot, International Kidney, Kerr's Pink, Roderick Dhu, Sharpe's Express, Ulster Monarch, and Up-to-Date) is intolerant of virus A and never shows crinkle (X+A); any severe mosaic is likely to be rugose mosaic (Y or X+Y). Group 3 (Arran Banner, Arran Chief, Arran Comrade, Arran Consul, Arran Scout, Arran Signet, Arran Victory, Catriona, Champion, Dunbar Cavalier, Flourball, Golden Wonder, Irish Chieftain, Majestic, and President) is tolerant of viruses X and A and shows crinkle (X+A) and interveinal mosaic (X+F), and some of the varieties may show rugose mosaic (X+Y) also. Varieties tolerant of the Y virus include Arran Consul, Arran Crest, Arran Victory, Champion, Di Vernon, Epicure, International Kidney, and Sharpe's Express. The term 'intolerance' as used above implies reaction by necrotic symptoms under experimental conditions and freedom of the variety in the field from the particular virus concerned [cf. ibid., xvii, pp. 338, 341].

A survey is given of the progress made in producing virus-free seed stocks. The new virus-free Champion variety is promising well and it is hoped that it will prove the beginning of a new class of really healthy seed.

Of other viruses present Up-to-Date streak (virus B) and paracrinkle in King Edward (virus E) are universal in these carrier varieties but are never seen on intolerant sorts. Viruses C and D are without practical importance, F and G are rare and their effect is slight apart from producing brown flecks in the tubers, probably included under the term 'spraing'.

LOUGHNANE (J. B.) & MURPHY (P. A.). **Mode of dissemination of Potato virus X.**—*Nature, Lond.*, cxli, 3559, p. 120, 1938.

In an experiment at the Albert Agricultural College, Glasnevin,

Dublin, to determine the mode of dissemination of potato virus X [see preceding abstract], four lots of cut pieces of healthy tubers were interplanted with infected tubers under varying conditions. The first lot of 27 pieces (A) was grown in pots on one side of a small insect-proof glasshouse compartment with the haulms of the healthy and diseased plants in contact, 14 of the healthy plants being in the same pot as a diseased plant, and 13 in separate pots. Contact was assisted by the play of an oscillating electric fan from a distance of 3ft. for about nine hours a week. The second lot (B) was grown on the opposite side of the house under identical conditions except for (*a*) the separation of diseased from healthy plants by cylinders of ½ in. wire netting round the former, and (*b*) the absence of the fan. The third lot (C) of 14 pieces was planted in three drills in the field with the diseased and healthy plants alternating at a distance of 1 ft., three of the healthy tubers and the adjacent diseased ones being planted in 9 in. pots sunk in the ground to minimize root contact. The fourth lot (D) was grown 4 ft. away under the same conditions except that the haulms of the diseased plants were enclosed in two cylinders of ½ in. wire mesh cylinders one inside the other with about 1 in. between.

The presence of virus X was determined by inoculation into *Datura stramonium* at intervals. All the plants from sound tubers proved to be free from virus X at first, but infection afterwards developed in each lot as follows: (A) 8 out of 27, (B) none, (C) 2 out of 14, (D) none. Of the 8 infected plants of (A), 3 were in separate pots and 5 in the same pot as a diseased plant. No evidence of infection through root contact was forthcoming either in (A) or (B).

In a further test in the greenhouse on the same general lines to assess the effect of the fan on plants from X-free tubers in separate pots, 4 out of 16 with haulms in contact became diseased under the influence of the fan, 1 out of 16 in contact without the fan, and none with the haulms separated. It appears from these data that virus X is readily disseminated within a potato crop by leaf contact, probably mainly under the influence of wind. It is unlikely that insects are implicated in the transmission of the disease, and the risk of underground infection is negligible.

Brentzel (W. E.). **'Purple top' wilt of Potato in North Dakota.**—*Plant Dis. Reptr*, xxii, 2, pp. 44–45, 1938. [Mimeographed.]

A potato wilt disease, referred to locally as 'purple top', has been troublesome in North Dakota since June 1937. In the middle of the month about 1 per cent. of the plants in a few fields showed traces of purple top, with no root symptoms; on 20th August, 3 to 5 per cent. of the plants were definitely diseased, showing small, crinkly leaflets purple about the veins. On 1st September, after warm weather, 20 per cent. of the plants had developed severe crinkling of the leaflets with purple veins, the discoloration extending down the main stems to ground-level. Aerial tubers were formed, the leaves wilted, and the plants drooped. No dwarfing was observed. The stolons were often 'beaded' and there was an abundant formation of fibrous roots. Often some of the root tips emerged from the ground and formed green shoots. Late potatoes gave a reduced yield, and many of the tubers were small.

Many tubers showed stem-end discolorations, and the stems were discoloured in the vascular region, particularly near the seed-piece, which was invariably rotted, and apparently constituted the focus of infection. The tubers were often soft or shrivelled, dull red, and very smooth, with shallow eyes. All the varieties examined (Triumph, Cobbler, and Ohio) were affected, and the disease occurred on all soil types. Many tubers from affected plants developed weak, spindly sprouts.

SANFORD (G. B.). **Studies on Rhizoctonia solani Kühn. III. Racial differences in pathogenicity.**—*Canad. J. Res.*, Sect. C, xvi, 2, pp. 53–64, 1 pl., 1938.

In continuation of these studies [*R.A.M.*, xvi, pp. 338, 769] the author gives details of experiments at Edmonton, Alberta, in which he tested the pathogenicity to young stems of the Early Ohio potato of 133 isolates of *Rhizoctonia* [*Corticium*] *solani*, 114 of which were obtained from random sclerotia collected on random potato tubers from four different fields, 13 from lesions on potato stems, and 8 from single basidiospores. Of this total only 18 per cent. proved to be highly virulent on young potato stems grown in a fertile virgin black loam, and 34 per cent. on stems grown in infertile white podsol soil, both at optimum moisture conditions, the percentages of non-pathogenic or very weakly pathogenic isolates being 72 and 48 for the two soils, respectively. Generally speaking these tests indicate that, under average soil conditions, approximately 20 to 50 per cent. of the isolates of the fungus from sclerotia on random tubers may be assigned to the zero or marginal classes of pathogenic rank; there was an indication that sclerotia from one field may be more dangerous than those from another, and some evidence was obtained that a fairly large proportion of the virulent isolates may arise from the *Corticium* stage, which may be prevalent in a field where the potato plants are markedly free from disease lesions.

It is believed that in having demonstrated the effect of soil type and racial differences in pathogenicity of *C. solani*, the results of this study may help to explain why the stems of a high percentage of plants from sclerotia-bearing setts often escape with little or no infection under field conditions.

EHRKE [G.]. **Kartoffel-Beizung. Ihre Bedeutung für Deutschland und die Möglichkeiten der praktischen Durchführung.** [Potato disinfection. Its importance for Germany and the possibilities of practical application.]—*Dtsch. landw. Pr.*, lxv, 7, pp. 75–76; 8, p. 92, 1938.

The writer discusses the advantages and drawbacks of seed-potato treatment against scab (*Actinomyces*) [*scabies*] and *Rhizoctonia* [*Corticium*] *solani* from the German grower's standpoint. An increased yield of 300 to 400 kg. per hect. would be necessary to cover the expenses of disinfection [cf. *R.A.M.*, iii, p. 603], and the unfavourable situation of Germany, both as regards climate and methods of agricultural organization, as compared with Holland, England, and Northern Ireland (where seed treatment with aretan [ibid., xvii, p. 293

and next abstract] is stated to be steadily gaining ground) must also be taken into consideration; the problem, however, demands thorough investigation. The various methods of seed-tuber and soil disinfection in current use in the United States against the two diseases under discussion are fully described [ibid., xvii, p. 92].

Erven (H.). **Aus der Praxis der Kartoffelbeizung zur Bekämpfung der Pockenkrankheit.** [Practical notes on Potato disinfection for black scurf control.]—*Dtsch. landw. Pr.*, lxv, 9, pp. 103–104, 6 figs., 1938.

Attention is drawn to the steadily increasing prevalence in Germany of recent years of the *Rhizoctonia* disease of potatoes [*Corticium solani*] and to the need for its control by seed treatment [see preceding abstract]. In this connexion the symptoms of the disorder are described and cultural measures for its prevention indicated. Hitherto the seed tubers have been treated with formaldehyde or corrosive sublimate, but since 1933 immersion for 20 to 30 minutes in 0·15 per cent. aretan has been officially recognized in Holland as the most practical means of combating the fungus, and the writer's recent experiments with this preparation in Germany have also given very satisfactory results. The cost of the treatment is estimated at Rm. 1.60 per 50 kg. of seed tubers. The temperature of the liquid should be maintained between 7° and 13° C., preferably round about 10°.

Aamisepp (J.). **Kartul läinud aasta kasvutingimustes, peamiselt Jôgeva katse-ja uurimistulemuste andmeil.** [The Potato under the vegetation conditions of the year 1937, with special reference to the outcome of researches at the Jôgeva Experiment Station.]—*Agronoomia*, xviii, 2, pp. 59–63, 1938. [Estonian, with German summary on p. 119.]

At the Jôgeva Experiment and Plant Breeding Station, Estonia, a high degree of resistance to potato blight (*Phytophthora infestans*) was shown by Böhm's Bodenkraft and two seedlings developed at the Station, 2170 and 1574. Wilt (*Verticillium albo-atrum*) was observed at Jôgeva for the first time during the period under review, attacking some of the yellow-fleshed varieties. Resistance to scab (*Actinomyces scabies*) was shown by the Station seedlings 2228–32. Good control of *Rhizoctonia* [*Corticium*] *solani*, which extensively affected early varieties, was obtained by tuber disinfection with aretan [see preceding abstracts].

Reddick (D.) & Mills (W.). **Building up virulence in Phytophthora infestans.**—*Amer. Potato J.*, xv, 2, pp. 29–34, 1938.

The virulence of a culture of *Phytophthora infestans* [*R.A.M.*, xvii, p. 267] was increased in experiments at Ithaca, New York, by passage though resistant potato varieties, viz., Evergreen (somewhat resistant), President (considerably resistant), and KB/5 (usually immune) in succession, to a point at which a number of hybrids giving an immune reaction in comparison with standard varieties, such as Green Mountain or Russet Rural, were severely blighted. A similar progressive increase of virulence occurred in September 1937 in a two-acre field containing 272 different lots of hybrids. The original source of infection was a small lot of potatoes separated by a wide hedge from KB/5. Blight

spread on 3rd September to a plant of 210/13, known to be susceptible, about 150 ft. from the hedge, and became abundant on this variety. Three days later 40 or 50 lots of plants, inoculated and found immune in greenhouse tests, were blighted whilst KB/5 remained uninfected. Finally on 22nd September large lesions were found on KB/5. A gap still exists, however, that has not been bridged either naturally or artificially between KB/5 and immune hybrids, such as ET/9, many of which remain free from infection by cultures of any degree of virulence.

Some speculative observations are made concerning the apparent loss of resistance to late blight in the Champion variety and the occurrence of physiologic specialization in *P. infestans*, with special reference to Berg's view, rejected by the writers, that two races of the fungus exist in North America, one primarily attacking potatoes and the other preferring the tomato as a host [ibid., vi, p. 583; cf. xv, p. 405].

ROTH (H.). **Ein Gang durch deutsche Hochzuchtstätten. Arbeiten und Ergebnisse der Saatkartoffel-Hochzucht C. Raddatz, Hufenberg und Wisbuhr b. Köslin (Pomm.).** [A tour through German plant-breeding stations. Work and results at the Seed-potato-breeding stations of C. Raddatz at Hufenberg and Wisbuhr, near Köslin (Pomerania).]—*Dtsch. landw. Pr.*, lxv, 5, pp. 51–52; 6, pp. 65–66, 5 figs., 1938.

Details are given of various aspects of the work of breeding disease-resistant and otherwise commercially acceptable potato varieties for seed at two stations in Pomerania, Germany. Four such varieties are Voran, Ostbote, Altgold, and Frühgold, all of which are immune from wart disease [*Synchytrium endobioticum*: *R.A.M.*, xvii, p. 198]; Voran and Ostbote are further resistant to 'Eisenfleckigkeit' [ibid., xvii, p. 410] and moderately so to scab [*Actinomyces scabies*: ibid., xvii, p. 413], while the former is subject only to occasional mild infection by *Phytophthora* [*infestans*: see preceding abstract], the last-named fungus being also virtually innocuous to Altgold. Frühgold is resistant to leaf roll and mosaic. Certain selections have further been developed which exhibit a high degree of resistance to the widespread A form of *P. infestans* [ibid., xvi, p. 403].

SCHLUMBERGER [O.]. **Kartoffelsortenprüfung auf Schorfwiderstandsfähigkeit.** [Potato variety testing for scab resistance.]—*Mitt. Landw., Berl.*, liii, 5, p. 99, 1938.

The annual German official potato trials for resistance to scab [*Actinomyces scabies*: see preceding abstract] on different soil types in the Mark Brandenburg [*R.A.M.*, xvi, p. 403] in 1937 involved 31 varieties, of which 24 were tested for the first, 5 for the second, and 2 for the third time. Only one of the varieties newly submitted for trial satisfied the requirements for commercial resistance (a minimum of 60 per cent. marketable tubers), namely, von Kameke 469/02. Similarly, von Kameke 477/31 and Volltreffer were the only representatives of the second- and third-year groups, respectively, to reach the necessary standard. Speisegelb, tested for the fourth successive year, was found to be only moderately resistant. The disappointing outcome of these

experiments emphasizes the necessity of exploring other methods of scab control, notably seed treatment.

Manns (T. F.) & Heuberger (J. W.). **Sweet Potato sprout treatments for the control of wilt disease.**—*Trans. Peninsula hort. Soc.*, xxvii, 5, pp. 127–130, 1937.

Two years' tests of copper and mercury compounds for the control of sweet potato wilt or stem-rot [*Fusarium bulbigenum* var. *batatas* and *F. oxysporum* f. 2: *R.A.M.*, xvi, pp. 369, 440] carried out at the Delaware and Maryland Experiment Stations on the sprouts of the susceptible variety Cederville showed that dipping the roots in various disinfectants was more successful than adding the materials to the tank on the transplanter. In practically all cases the setting of sprouts with McCall's nutrient solution stimulated the early growth of the plant, although better control of wilt resulted from setting with water in conjunction with the fungicidal treatments. Several of the fungicides used reduced the disease to an average of 4 to 5 per cent. in 1936 and 3 to 7 per cent. in 1937, whereas the untreated sprouts averaged 64 per cent. and 31 per cent. wilt, respectively, in the two years. Of the insoluble copper compounds tried basic copper sulphate at a rate of 2½ lb. in 50 gals. gave the highest yield of primes and the highest total yield; copper zeolite (5–50) and cuprocide (1½–50) also controlled the disease satisfactorily, giving as good results as new improved semesan bel or mercuric chloride. The insoluble copper compounds have the advantage of being cheaper than the mercury preparations, are less toxic to the plant tissue, and cause less retardation to the growth of the plants.

Hanson (E. W.). **Parasitism and physiologic specialization in Fomes lignosus.**—Abs. in *Phytopathology*, xxviii, 1, p. 8, 1938.

Hevea rubber and *Ficus elastica* in soil artificially inoculated with a Liberian culture of *Fomes lignosus* [*R.A.M.*, xvii, p. 202] in Minnesota developed typical white root symptoms five weeks after infection and were dead in six weeks. The fungus was present in profusion in the dead root tissues, from which it was re-isolated and found to agree in all respects with the original cultures. *F. lignosus* was further shown by inoculation experiments to be pathogenic to Navy beans [*Phaseolus vulgaris*], soy-beans, cowpeas, and garden peas. Comparative studies on the Liberian strain of the fungus and a Malayan culture revealed important differences, the latter, for instance, producing a finer and more rapidly growing mycelium than the former. The optimum temperatures of the Liberian and Malayan strains are 27° and 32° C., respectively, and the latter requires considerably more moisture for optimum growth than the former.

Deyl (M.). **Ueber die Mikrobiologie der alpinen Böden in den Ostkarpathen.** [On the microbiology of the alpine soils in the eastern Carpathians.]—*Stud. bot. Čechoslov.*, i, 1, pp. 10–19, 1 graph, 1938.

A tabulated account is given of the writer's studies on the microflora of various soil types in Czechoslovakia, from the results of which it appears that [unspecified] fungi predominate over bacteria in the upper horizons of the more acid soils. They are probably largely responsible

in silicate soils for the initial processes of the disintegration of plant refuse. As regards the particular ecological associations investigated, the numbers of fungi per gm. of damp soil underlying *Vaccinium myrtillus* at depths of 5, 12, 20, and 50 cm. were 800,000, 100,000, 70,000, and 60,000, respectively; under *Juncus trifidus* at 5, 15, and 30 cm. 500,000, 200,000, and 130,000, respectively; under *Vaccinium uliginosum* and *Carex sempervivens-V. myrtillus* at 5 and 25 cm. 600,000 and 200,000, respectively; under *Adenostylum alliaria* at 5 and 45 cm. 400,000 and 200,000 respectively; under *Calamagrostis villosa* at 5 and 45 cm. 300,000 and 120,000, respectively; and under *Deschampsia caespitosa* at 5 and 70 cm. 300,000 and 50,000, respectively. Moulds were the principal agents of cellulose decomposition, a process which was, however, very slowly and ineffectually accomplished by these organisms.

D'Oliveira (B.). **New hosts for the aecidial stage of Uromyces graminis (Niessl) Diet.**—*Bol. Soc. broteriana*, Sér. II, xiii, pp. 81–89, 2 pl., 1938.

A genetic connexion was established by means of cross-inoculation experiments between *Uromyces graminis* on *Melica ciliata* and *Aecidium foeniculi*, the latter observed in profusion on fennel (*Foeniculum vulgare*) leaves, stems, and buds near Lisbon in 1935. Among the 15 species of Umbelliferae successfully inoculated with the sporidia of *U. graminis* were carrot, coriander (*Coriandrum sativum*), and two horticultural varieties of parsley. The aecidial stage of the rust appears to be restricted to fennel in Portugal.

Schindler (H.). **Der Pfefferminzrost.** [Peppermint rust.]—*Kranke Pflanze*, xv, 2, pp. 28–30, 1938.

A semi-popular account is given of peppermint (*Mentha piperita*) rust (*Puccinia menthae*) [*R.A.M.*, xvii, p. 6], which is stated to be responsible for heavy damage to the German crop. Attention is drawn to the importance of climate in the cultivation of peppermint and the choice of protected situations in localities with a relatively mild winter is recommended, as well as an annual change of site of the beds.

Baines (R. C.). **Mint anthracnose.**—*Phytopathology*, xxviii, 2, pp. 103–113, 3 figs., 1 graph, 1938.

Black peppermint (*Mentha piperita* var. *vulgaris*) and spearmint (*M. spicata*) in Indiana are subject to anthracnose (*Sphaceloma menthae*) [*R.A.M.*, xvii, p. 203], severe infection by which results in defoliation and young stem and stolon blight, causing appreciable losses. The disease was induced by artificial inoculation on white (*M. piperita*), black, and State peppermints, common and Scotch spearmint, and Japanese mint (*M. arvensis* var. *piperascens*). The mycelium is largely intercellular and sparsely distributed in the necrotic tissue. The unicellular conidia are sessile on a superficial stroma. The fungus grows slowly on malt extract, potato dextrose, and Leonian's agar media, producing a brown, heaped type of colony. Good growth was obtained at a temperature range of 14° to 28° C. on media adjusted to P_H values between 3·6 and 8·2. Infection and the development of the disease were favoured by temperatures ranging from 21° to 26·8°. *S. menthae*

overwinters on infected mint refuse and is introduced into new fields on diseased plants.

UPPAL (B. N.), PATEL (M. K.), & KAMAT (M. N.). **Alternaria blight of Cumin.**—*Indian J. agric. Sci.*, viii, 1, pp. 49–62, 3 pl., 1938.

English and Latin diagnoses are given of *Alternaria burnsii* n.sp., the agent of a sporadic blight of the living branches, leaves, and fruit of cumin (*Cuminum cyminum*) occurring along water channels and shady places in the Kaira district of Gujarat, India [*R.A.M.*, xiv, p. 560]. Affected plants show minute, whitish, necrotic areas which turn purple, later brown, and finally black, the disease ultimately causing the death of the whole plants or only of the affected parts. On potato dextrose agar the pale olive-green hyphae are 1·7 to 5·8 μ in diameter; the solitary or fasciculate, erect, simple or branched, straight or bent, geniculate conidiophores, sometimes with a single terminal scar, are 3- to 5-celled (rarely 8-celled on the host), and measure 15 to 52 by 1·9 to 3·7 μ; the obovate, occasionally obclavate, olive-brown conidia, borne singly on the host but in chains of 2 to 10 in culture, are furnished with 1 to 9, mostly 3 to 5 transverse septa, taper towards the apex, which may be elongated into a beak often as long as the spore, and measure 13·8 to 55·1 by 6·9 to 25·2 μ without the beak and 23 to 118·9 by 7 to 29·9 μ with it.

The minimum, optimum, and maximum temperatures for the development of *A. burnsii* were found to be 4·5°, 26° to 30°, and 35° C., respectively. Under local conditions the optimum generally prevails during the growing period of the host (November to February), and humid conditions at the same time contribute to destructive attacks of the blight. The scanty amount of seed produced by affected plants is shrivelled, discoloured, and of poor germinability. Maltose, dextrose, and levulose constituted the best sources of carbon. A modified Richards's agar (omitting potassium nitrate) and the same plus sodium asparaginate proved to be most favourable for the nitrogen metabolism of the fungus. Of the liquid media tested, Meyer's was the most suitable, followed by Richards's and Czapek's. The optimum hydrogen-ion concentration for growth appears to lie between P_H 6 and 7. The fungus is highly pathogenic to its own host (in the presence of moisture only), but cross-inoculation experiments on eight other plants gave negative results. *A. burnsii* was shown to be capable of oversummering on plant debris in the field, while infected seed is probably also instrumental in the perpetuation of the fungus and the initiation of primary infection.

Outbreak of Fiji disease.—*Aust. Sug. J.*, xxix, 11, pp. 688–689, 1938.

About 17 farms in the Qunaba and Tantitha districts, near Bundaberg, Queensland, are stated to be affected by the recent outbreaks of Fiji disease of sugar-cane [*R.A.M.*, xvii, p. 345], which, according to N. J. King, Officer in charge of the Bundaberg Experiment Station, constitutes a serious threat to P.O.J. 2878, extensively cultivated in the area on account of its resistance to gumming disease [*Bacterium vasculorum*]. Varieties resistant to Fiji disease include P.O.J. 213 and 234, Co. 290, Oramboo, Korpi, and Q 813. Growers are urged to co-operate

with the Experiment Station authorities in the adoption of energetic measures for the elimination of the disease.

MARTIN (J. P.). **Pathology.**—*Rep. Hawaii Sug. Exp. Sta., 1937* (ex *Proc. Hawaii Sug. Pl. Ass. 1937*), pp. 28–34, 1938.

In this report [cf. *R.A.M.*, xvi, p. 561] it is stated that leaf burn observed in localized areas of a field of 28–2055 sugar-cane was shown by borings to be due to variation in soil depth. Where the condition was severe the soil ranged from 15 to 20 in. in depth, whereas in the healthy areas it was over 3 ft. deep.

Eye spot [*Helminthosporium ocellum*: ibid., xvi, p. 516] was a serious problem on several plantations, the commercial variety most severely affected being H 109. The rapid spread of the fungus was favoured by frequent rains, and epidemics may therefore be expected from time to time where a susceptible variety is grown. Initial outbreaks usually occur year after year in the same locality, and as environmental conditions are so favourable to infection in these districts every effort should be made to replace susceptible by resistant varieties. In the section of this report dealing with genetics (by A. J. Mangelsdorf and C. G. Lennox) it is stated (pp. 40–41) that, contrary to the opinion previously held, a cane susceptible to eye spot is everywhere a potential danger, and is of little interest from a commercial point of view.

Varieties making subnormal growth owing to drought or soil infertility are almost invariably more susceptible to leaf scald (*Bacterium albilineans*) [ibid., xvii, p. 66] than varieties growing normally. Owing to the recently more favourable conditions for growth the disease has caused only small losses even in areas where it was previously serious.

Observations during a varietal resistance trial laid down in May and June, 1935, and harvested in April, 1937, in which cuttings of 170 sugar-cane varieties were inoculated with *Bact. albilineans* before planting, demonstrated that leaf scald symptoms appeared only on the highly susceptible varieties 29–3859 and Waipahu 153, which had a low degree of tolerance even when conditions were unfavourable to infection; it can be assumed that most commercial varieties now grown locally are highly resistant. In September, 1937, all the varieties under test were cut back, and a heavy suspension of *Bact. albilineans* was brushed over the cut surfaces of the stubble. The results indicated that the disease is much more easily transmitted in this way than by inoculating the cuttings before planting. In another experiment healthy Waipahu 153 cane was grown in three cages until millable cane was available, and rats fed on Yellow Caledonia cane affected by leaf scald were then allowed to feed on the stalks in two of the cages, with the result that the stalks chewed by the rats became infected. It is therefore concluded that under field conditions rats can transmit the disease.

RANDS (R. D.) & DOPP (E.). **Influence of certain harmful soil constituents on severity of Pythium root rot of Sugar-Cane.**—*J. agric. Res.*, lvi, 1, pp. 53–67, 3 figs., 2 graphs, 1938.

A detailed account is given of greenhouse experiments on the effect of hydrogen sulphide and salicylic aldehyde on the susceptibility of

sugar-cane plants grown in sand-nutrient cultures to root rot caused by *Pythium arrhenomanes* [see above, p. 476], both compounds being selected as examples of the deleterious substances that may arise during temporary waterlogging in poorly drained, heavy clay soils of the Louisiana sugar district. The results showed that hydrogen sulphide by itself, at concentrations of 10 and 50 p.p. million, reduced the growth of the sugar-cane tops by approximately 21 and 26 per cent., respectively. *P. arrhenomanes* alone reduced it by 31 per cent., and both in combination by 30 and 36 per cent., indicating the absence of any special influence of the sulphide on the intensity of disease. Salicylic aldehyde alone, on the other hand, at concentrations of 20 to 40 p.p.m. had little if any effect on cane growth and no effect on the fungus in culture, but in combination with the latter it reduced the weight of the plants from two to seven times as much as *P. arrhenomanes* alone. It is considered, therefore, that the presence of this or similarly behaving compounds in the soil would account at least in part for the frequently severe root rot observed in all but the most resistant sugar-cane varieties, a conception supported by the marked increase in yield which has in numerous instances resulted even in resistant varieties from improved drainage and amelioration of soil fertility.

TATE (H. D.). & WADLEY (F. M.). **Studies on Sugar Cane insects in Puerto Rico.**—*Agric. Notes, Mayaguez Exp. Sta., P.R.*, 83, 1938. [Abs, in *Facts ab. Sug.*, xxxiii, 4, p. 38, 1938.]

Sugar-cane mosaic is stated to be transmissible in Porto Rico by three insects, viz., *Aphis maidis*, occurring all over the island but mostly in small numbers, except on maize; *Hysteroneura setariae* [*R.A.M.*, xv, p. 743], commonly found on grasses and in the southern coastal region also on sugar-cane (as in Louisiana) [ibid., xvii, p. 67]; and *Carolinaia cyperi*, widely distributed on the ubiquitous 'coqui' [*Cyperus rotundus*]. *A. maidis* is most abundant in the rainy season and the other two during dry weather. The spread of mosaic is more rapid on cane near other kinds of plants than in solidly planted blocks of cane covering large areas.

WEST (J.). **A preliminary list of plant diseases in Nigeria.**—*Kew Bull., 1938*, 1, pp. 17–23, 1938.

Included in this list (arranged in alphabetical order of the hosts) of over 130 fungal, bacterial, virus, physiological, and undetermined diseases affecting 55 hosts in Nigeria are all the available records of previous workers on mycology in the Colony, in addition to the author's own collections.

BOYLE (L. W.) & MCKINNEY (H. H.). **Local virus infections in relation to leaf epidermal cells.**—*Phytopathology*, xxviii, 2, pp. 114–122, 1938.

This is an expanded account of the writers' studies on the relative importance of trichomes and other leaf epidermal cells as points of entry for the tobacco mosaic virus, a note on which has already been published [*R.A.M.*, xvi, p. 766].

Spencer (E. L.). **Seasonal variations in susceptibility of Tobacco to infection with Tobacco-mosaic virus.**—*Phytopathology*, xxviii, 2, pp. 147–150, 2 graphs, 1938.

In this study at the Rockefeller Institute for Medical Research, Princeton, New Jersey, once each week for 129 consecutive weeks (from 1935 to 1937) 126 seedlings of Turkish tobacco were transplanted into pots and three days later inoculated with tobacco mosaic (Johnson's tobacco virus 1). The results showed definite variations in the susceptibility of plants to infection by the virus. Susceptibility was found to reach a maximum during the early summer (June and July), when high temperatures (approximately 80° to 83° F.) prevailed, accompanied by protracted sunshine (about 11 hours daily), and to decline during the late winter and early spring. The incubation period of the virus within the plant showed a direct correlation with seasonal fluctuations in light and temperature, lasting only four to five days in June and July compared with six or seven in December and January.

Thornberry (H. H.), Valleau (W. D.), & Johnson (E. M.). **Inactivation of Tobacco-mosaic virus in cured Tobacco leaves by dry heat.**—*Phytopathology*, xxviii, 2, pp. 129–134, 1 graph, 1938.

A tabulated account is given of the writers' tests at the Kentucky Agricultural Experiment Station in the inactivation by dry heat of the mosaic virus in two lots of White Burley Tobacco, one cured in 1882 and still retaining some mosaic virulence, and the other in 1936, infected by the yellow, green, and burning strains of tobacco mosaic. Part of the latter material, after seven days' drying at room temperature over concentrated sulphuric acid, was powdered, placed in cotton-plugged glass vials, and exposed to heat in an electric oven, while the rest was twisted and allowed to dry in the laboratory before heating. The infectivity of the samples was measured by the local-lesion method on primary Scotia bean [*Phaseolus vulgaris*] leaves.

The three strains of the virus exhibited a similar degree of tolerance in respect of dry heat, all the samples remaining infectious after the maximum exposure of 60 hours at 70° C., while at 80°, 90°, 100°, 110°, 120°, 130°, 140°, and 150° the times for complete inactivation were 50, 20, 10, 5, 1, 0·5 to 0·4, 0·4, and 0·4 hours, respectively. Virus in green tobacco (92 per cent. moisture) remained infectious after 70 hours' exposure to temperatures of 70° and 80°, whereas at 90°, 100°, and 110° it was totally inactivated in 2, 2, and 1 hours, respectively. Virus inactivation in tobacco samples cured in 1882 was similar to that in samples recently cured.

Thung (T. H.). **Phytopathologische waarnemingen.** [Phytopathological observations.]—*ex* Jaarverslag Oogstjaar 1936–1937.—*Meded. Proefst. vorstenl. Tab.*, 85, pp. 25–39, 1938.

Further substantial progress was made during the period under review in the control of tobacco mosaic in the Vorstenland (Java) tobacco plantations [*R.A.M.*, xvi, p. 779] by the use of formalin for disinfecting the workers' hands prior to planting operations. Under local conditions there is little likelihood of the persistence of the virus

in the soil after the roguing out of diseased plants, but in order to guard against this eventuality it may be well to replace the infected material by plants affected by mild mosaic, which exerts a protective action against the severe form [ibid., xvi, p. 414], and was shown in experiments with the hybrid variety Chlorina × KW 10 to cause much smaller reductions in yield.

As pointed out in the previous year's report, slime disease [*Bacterium solanacearum*] is locally increasing in prevalence, whereas the incidence of *Phytophthora* [*parasitica nicotianae*] appears to be declining, partly owing to the cultivation in the critical areas of the resistant Timor variety. Two Deli [Sumatra] selections, A and B, compared favourably with Y 10, an American selection, and an Ambalema cross in resistance to *Bact. solanacearum* in a test on one estate.

The virtual freedom of the Vorstenland from mildew [*Erysiphe cichoracearum*] during the 1936–7 season is attributed to the timely application of sulphur and the cultivation of the resistant Timor variety. A further increase in the prevalence of the highly infectious stem-rot (*Bacillus* [*Erwinia*] *aroideae*) was registered.

De Fluiter (H. J.). **Alternaria longipes (Ell. en Ev.) Mason, de verwekker van de bruinvlekziekte in de Besoeki Tabak.** [Alternaria longipes (Ell. & Ev.) Mason, the agent of the brown spot disease of Besoeki Tobacco.]—*Meded. besoek. Proefst.* 59, pp. 1–16, 15 figs., 1938. [German summary.]

In 1937 the Besoeki (Java) tobacco crop was severely attacked by *Alternaria longipes* [*R.A.M.*, xiii, p. 804], the agent of the brown leaf spot disease. The brown lesions on the foliage are zonate, frequently surrounded by a yellow ring, sometimes convergent, and the affected tissues are brittle. Brown, sunken spots may also develop on the veins, petioles, stems, and seeds. This is the first actual record of the disease in the Dutch East Indies, where it has, however, probably long been present without attracting attention.

The fungus was grown in pure culture on plum, cherry, and oats malt agar, of which the two former induced copious mycelial production while the last-named stimulated early and profuse conidial development. Inoculation experiments gave positive results on the following tobacco varieties (in ascending order of susceptibility): Connecticut Shade, Timor, Adonara, Connecticut Shade × 238, Connecticut Shade × 343, Hybrid 238, Kedoe, and Hybrid 343. In the field the Kedoe lines 103, 286, 292, 303, 320, and 322 proved to be the most susceptible, closely followed by Hybrids 238 and 343. The opportunities for infection among these strains are multiplied by their slow maturing habit, necessitating late harvesting. This factor is eliminated in the early ripening cover-leaf types, and it has been observed that crosses Havana 413 with Canary and Hybrids 238 and 343 are much less liable to infection at harvesting.

The mean day temperature in the Besoeki district corresponds with the optimum (25° to 28° C.) for the growth of *A. longipes*, but it is only in relatively dry seasons such as that of 1937 that serious outbreaks are likely to occur. Economic and hygienic considerations preclude the application of chemical treatment to the infected plants, and control

should therefore be based on such cultural measures as timely harvesting, drastic field sanitation, and crop rotation.

KOSMODEMIANSKI (V. N.) & LEVYKH (P. M.). Устойчивость сортов Табака и диких видов **Nicotiana** к поражению **Thielaviopsis basicola** (корневая гниль). [The resistance of some cultivated and wild Tobacco varieties to *Thielaviopsis basicola* (root rot).]—Всесоюзн. научноисслед. Инст. Табачн. Махорочн. Пром. им. А. И. Микояна. (ВИТИМ). [*The A. I. Mikoyan pan-Soviet sci. Res. Inst. Tob. and Indian Tob. Ind.* (*VITIM*)], Krasnodar, *Publ.* 132, pp. 5–17, 1936. [Received May, 1938.]

The root rot disease of tobacco due to *Thielaviopsis basicola* [*R.A.M.*, xv, p. 751; xvii, p. 418] is stated to occur in the U.S.S.R. in the Azov–Black Sea Region, Caucasus, and the Ukraine and to cause in some years reductions in yield of over 30 per cent. In the course of three years' experiments on the breeding and selection of disease-resistant varieties, the authors found that some of the varieties, e.g., White Burley from the United States, described as resistant in other countries, proved to be susceptible under Russian conditions. In testing the resistance of plants to the disease the roots were inspected after harvest and the degree of infection registered by a three-mark scale. The results showed that the varieties Dubek 44, American 572 and 8, Varatik 26, and Trebizond 1867, 1865, and 1866 were highly resistant; some of the varieties manifested different degrees of infection in the seed-bed and in the field. The most resistant varieties were found to come from the countries bordering the Mediterranean (western districts of U.S.S.R. including Crimea, Rumania, Bulgaria, Yugoslavia, Greece, and parts of Italy), and the most susceptible from North and South America. Among the wild species of *Nicotiana* tested *N. sanderae* and *N. noctiflora* were immune from the disease, *N. glauca* and *N. repanda* showed high resistance, and *N. glutinosa* high susceptibility.

BOYCE (J. S.). **Forest pathology.**—x+600 pp., 215 figs., 1 diag. London, McGraw Hill Publishing Co., Ltd., 1938. Price 30s.

In his preface to this eminently useful and copiously illustrated treatise on forest pathology, the author explains that it is intended to serve both as a text and reference book. The subject is treated mainly from the standpoint of the practical forester, without entering into lengthy taxonomic or morphological discussions of purely academic interest. Following a brief introduction are chapters on disease and fungi in general, non-infectious diseases, seedling diseases, root diseases, foliage diseases of hardwoods and conifers, stem diseases, of both groups, comprising conifer rusts and cankers, hardwood cankers, galls, witches' brooms, fasciations, phanerogamic parasites, and the like, stem decay, rots of various types, deterioration of dead timber and of forest products, and principles of forest-disease control. Each chapter is supplemented by a list of relevant bibliographical references, while appendix A gives brief directions for the preparation of standard fungicides and wound dressings, and B lists the common names of trees with their scientific equivalents.

Koning (H. C.). **Bacterial canker of the Poplar.**—*Chron. bot.*, iv, 1, pp. 11–12, 1938.

The bacterium isolated at the 'Willie Commelin Scholten' Phytopathological Institute, Baarn, Holland, from the slimy exudate of poplars suffering from a special form of canker in the Netherlands, is designated *Pseudomonas rimaefaciens* n.sp. [without a diagnosis]. The disease, which occurs also in Belgium, France, England, and probably Italy, chiefly affects local varieties of obscure origin, such as hybrids of *Populus monilifera* and *P. nigra*, while the balsam group [*P. balsamifera*] is also very susceptible. Poplars in Holland are also liable to occasional infection (sometimes in conjunction with the new bacterium) by *Nectria galligena* [*R.A.M.*, xiv, p. 794]. The bacterial canker may be distinguished from the fungal form by local swellings on the pale-coloured bark, the emission from cracks or lenticels of a slimy exudate, irregularly shaped callus walls, the formation of small, red stripes in the wood, the specially rapid development of infection in the spring, and the radial advance of the pathogen in the wood.

Wolf (F. A.). **Life histories of two leaf-inhabiting fungi on Sycamore.**—*Mycologia*, xxx, 1, pp. 54–63, 14 figs., 1938.

The results of the author's studies showed that the serious leaf blight of the sycamore (*Platanus occidentalis*) in the Duke Forest, North Carolina, is mainly caused by *Stigmina platani* [*R.A.M.*, ix, p. 72], usually in association with *Cercospora platanicola* [printed in error as *C. platanifolia*: see *Mycologia*, xxx, p. 243]. The lesions induced by the latter are the first to become apparent about mid-June, in the form of very irregular, minute, brown, necrotic spots, bearing spores on both sides of the leaf; after the development of the *S. platani* lesions, however, which first appear towards the end of July, the *C. platanicola* fructifications are mostly hypophyllous, and are widely interspersed with those of *S. platani*. Spermogonial and perithecial primordia begin to form concurrently, prior to the abscission of the infected leaves, on the lower leaf surface; the spermatia are liberated for about two months from about the middle of September. It was not possible to establish whether both fungi have spermogonial stages, chiefly because all the spermogonia on the lesions are similar as are also the spermatia, but spermogonia were obtained in pure culture from *S. platani* conidia. The perithecia which attain maturity on leaves which have overwintered in the open are characteristic of the genus *Mycosphaerella*, and are all quite similar in size; they were found, however, to belong to two distinct groups, one with asci measuring 55 to 70 by 9 to 11 μ, containing ascospores 17 to 19 by 6 to 7 μ, and the other with asci measuring 30 to 36 by 7 to 8 μ, containing ascospores 8 to 10 by 4 to 4·5 μ in diameter. In pure culture the first group was shown to belong to *S. Platani*, and as it does not agree with the other species of *Mycosphaerella* recorded on *Platanus* it is described as new under the name *M. stigmina-platani* [with a Latin diagnosis]. The second group agrees well and is believed to be identical with *Sphaerella platanicola* Cooke, and is renamed *M. platanicola* [with a revised Latin diagnosis].

A comparison of *Stigmella platani-racemosae* [*R.A.M.*, ix, p. 347]

with *Stigmina platani* leads the author to consider that the two organisms are closely related; so long as the two form-genera *Stigmina* and *Stigmella* are retained, however, the two species should be regarded as generically distinct (cf. ibid., xvii, p. 137).

Le dépérissement de l'Ailante (verticilliose). [The dying-off of Ailanthus (verticilliosis)].—*Ann. Éc. Eaux For. Nancy*, vi, 2, pp. 303–308, 1937. [English summary on p. 310. Received April, 1938.]

The information herein presented on the dying-off of *Ailanthus glandulosa* in the Paris region due to infection by *Verticillium dahliae* has already been noticed from another source [*R.A.M.*, xv, p. 183].

NÄGELI (W.). **Balais de sorcière sur l'Épicéa.** [Witches' brooms on the Spruce.]—*J. for. suisse*, lxxxix, 2, pp. 37–41, 1 fig., 1938.

In connexion with an account of a non-parasitic witches' broom on *Picea excelsa* var. *globosa* in the Chassagne Forest, above the Neuchâtel–La Chaux de Fonds railway, Switzerland, the writer briefly summarizes Tubeuf's studies on the subject of the various types of this malformation on woody plants [*R.A.M.*, xii, p. 663]. Mention is further made of two Swiss observations on the inheritance of witches' brooms, in one of which Schröter (*Schweiz. Z. Forstw.*, p. 52, 1934) found that the seeds of an affected spruce gave rise to a quantity of small plants with dense foliage of the witches' broom type. In the other instance A. Engler states (*Ann. Sta. Rech. for. suisse*, viii, 2) that among the five-year-old progeny of Ringgenberg's 'bushy' spruce, 53 per cent. were definitely globular, 16 per cent. normal, and 31 per cent. displayed transitional characters.

ZYSKÓWNA (ZOFIA). **Przyczynek do flory mikologicznej rezerwatu jodłowego uroczyska Yata w. Nadleśnictwie Państwowym Łuków.** [Contribution to the mycological flora of the Silver fir reserve at Yata in the government forests of Łukow.]—*Trav. Inst. Rech. For. doman. Varsovie*, Ser. A, 21, 27 pp., 15 pl., 43 figs., 1936. [French summary. Received April 1938.]

The author gives a carefully annotated list of 30 fungi (29 Polypores) found on various trees in the silver fir (*Abies pectinata*) [*A. alba*] reserve at Yata, near Łukow, Poland, illustrated with drawings of cystidia and spores of each species and a number of photographs of the sporophores.

MEHLISCH (K.). **Ein pilzlicher Schädling an Abies.** [A fungal pest of *Abies*.]—*Blumen- u. PflBau ver. Gartenwelt*, xlii, 8, p. 92, 1938.

Of recent years *Abies nordmanniana* and *A. nobilis* in German nurseries have been attacked by *Cucurbitaria pithyophila* [*R.A.M.*, vi, p. 202], which produces nodular swellings on the forks of the branches. The fungus, which is characterized by concatenate, cubical spores, also infects *Pinus sylvestris*, *P. cembra*, *P. strobus*, *Picea excelsa* [*P. abies*], and *A. alba*, commonly killing young plants. *P. abies* and *P. pungens* are also liable to invasion by *C. piceae*, causing a snail-like twisting of the buds. Surviving plants slough off the diseased cortex, and are thus left without protection against other fungi and insects. Infected conifers should be removed from the nursery to avoid any further extension of the disease.

ROHDE (T.). **Ueber den Krankheitsverlauf bei der Schweizer Douglasienschütte.** [On the course of the disease in the needle-fall of Douglas Fir.]—*Z. PflKrankh.*, xlviii, 2, pp. 49–57, 1 graph, 1938.

Further studies in south Germany on the Swiss needle-fall of Douglas firs [*Pseudotsuga taxifolia*] caused by *Adelopus gäumanni* [*R.A.M.*, xvii, p. 361] confirmed previous observations as to the ability of the fungus to induce primary infection of the young needles, to which in many cases the initial attacks are, in fact, confined. The whole of the current season's growth is probably seldom, if ever, invaded by *A. gäumanni* in the early stages of its development, though once its virulence reaches a climax it does not spare a single needle of the newly emerging shoots. In this respect the agent of Swiss needle-fall presents a striking contrast to *Rhabdocline pseudotsugae*, which from the onset attacks a high proportion of the needles but almost invariably leaves a certain number untouched, even in epidemic outbreaks of infection. Further investigations have been initiated to determine the exact extent to which the older Douglas fir needles are involved in infection by *A. gäumanni*.

JUMP (J. A.). **A new disturbance of Red Pine.**—*Science*, N.S. lxxxvii, 2250, pp. 138–139, 1938.

Pinus resinosa in the north-eastern section of the United States has been affected since 1933 by a condition, thought to be of fungal origin, characterized by the extra-seasonal growth of one or more lateral buds in the terminal bud-cluster and the subsequent 'forking' of the tree. The precocious laterals assume a more vertical position than normal, and the renewed growth of the terminal bud results in the forked appearance. The forked branch as a rule fails to unite on its upper surface with the bole, and a resinous pocket, surrounded by discoloured wood, usually occurs at the area of non-union, forming an ideal environment for fungi.

Representative plots from some 800 acres of *P. resinosa* 5 to 25 years old showed 68 to 94 per cent. of the trees to be affected. The condition, which is seldom permanent, occurs on soils varying in P_H value from 4·5 to 7·5, and in texture from sandy to clay loam. It occurs in young natural reproduction as well as in plantations, and is found in both mixed and pure stands. Evidence at hand strongly suggests a fungus as the cause of the disease, but further investigations are in progress.

BUCHANAN (T. S.) & KIMMEY (J. W.). **Initial tests of the distance of spread of infection on Pinus monticola by Cronartium ribicola from Ribes lacustre and R. viscosissimum.**—*J. agric. Res.*, lvi, 1, pp. 9–30, 2 diags., 8 graphs, 1938.

The results of observations since 1928 on the spread of white pine blister rust (*Cronartium ribicola*) [*R.A.M.*, xvii, p. 360] from artificially established and maintained infection foci on *Ribes lacustre* or *R. viscosissimum* in stands of naturally regenerating western white pine (*Pinus monticola*) in British Columbia indicated that these two species of *Ribes* are capable of spreading essentially equal infection to the adjacent pines per foot length of live stems. Within a circular acre averages of six tests with *R. lacustre* showed that infection from 155·8 ft. live stems resulted in 7·5 per cent. of the pines becoming infected in a single year, 2·9 per cent. of the trees suffering sufficient damage to

prevent those trees from reaching merchantability, the corresponding figures for *R. viscosissimum* being 88·5 ft., 4·5 per cent., and 2·3 per cent.; the results obtained on the individual plots, however, showed no direct or consistent relationship between the number of feet of live stem and the resultant pine infection for either of the species, owing to the multiplicity of factors involved. Under the conditions of the tests infection spread to a distance of at least 150 ft. from the foci (up to about 250 ft. for *R. viscosissimum*), and was most intensive close to the infected currants, falling off to relatively low values at a distance of 50 to 60 ft. from them; the percentage of damage caused by the rust to the pines followed a similar curve of reduction with increasing distance from the infection foci. It is calculated that, under conditions comparable to those of the tests, it is possible for as little as 14·4 ft. of *R. lacustre* live stems and 31 ft. of *R. viscosissimum* stems to be responsible for damage to 2·8 and 5·6 per cent., respectively, of the regenerating pines.

The results of the investigation indicate the necessity of the eradication of both *Ribes* species in regions to be reafforested with *P. monticola*, and under some conditions at least the eradication should be done with extreme thoroughness.

Boswell (J. G.). **The biochemistry of dry-rot in wood. III. An investigation of the products of the decay of Pine wood rotted by Merulius lachrymans.**—*Bio-chem. J.*, xxxii, 2, pp. 218–229, 1938.

Continuing his studies (begun in collaboration with E. C. Barton-Wright) on the biochemistry of *Merulius lacrymans* [*R.A.M.*, x, p. 635] at Sheffield University, the writer fully describes and tabulates the results of his analyses of the constitution of the cellulose-containing, water-, and dilute alkali-soluble fractions prepared from two samples of pine (probably *Pinus resinosa*) panelling, one more severely rotted than the other. The early stages of the attack on cellulose were clearly shown to be hydrolytic, the process being extremely rapid even in its initial phase. In the more severely decayed sample the cellulose content had fallen to 14·83 per cent. and the lignin risen to 40·42 per cent. compared with 60·48 and 23·17 per cent., respectively, in a control sample of sound wood, the corresponding figures for the less extensively rotted wood being 28·81 and 27·61 per cent., respectively. The molecular size of the final product of cellulose hydrolysis is uncertain, but there are indications that it is not smaller than a trisaccharide. Certain reducing compounds were isolated from the water-soluble fraction, possibly (together with the alcohol-soluble material) representing intermediate stages in the respiration of the fungus, though they may be waste products.

Rabanus (A.). **Beitrag zur laboratoriumsmässigen Prüfung von Holzschutzmitteln.** [A contribution to the testing of timber preservatives by laboratory methods.]—*Angew. Bot.*, xix, 6, pp. 579–586, 2 graphs, 1938.

The writer describes and discusses the results of tests by the standard toximetric method of the efficacy of three wood preservatives, basilit N extra, basilit U, and basilit UA [*R.A.M.*, xvi, p. 503], against

Coniophora cerebella [*C. puteana*] on pine and beech, *Lenzites abietina* on pine, and *Polystictus versicolor* on beech, and (with the last-named preparation only) *Polyporus vaporarius* [*Poria vaporaria*], *Lentinus squamosus*, and *Merulius domesticus* [*M. lacrymans*]. Basilit UA (containing arsenic in addition to sodium fluoride and dinitrophenol) was found to be much more resistant than basilit N extra to leaching-out, and the duration of life of telegraph poles and railway sleepers treated with the former should therefore considerably exceed the average of 16 years estimated for the latter. Basilit U (containing bichromate) will probably occupy an intermediate position between the two foregoing. Basilit UA should be applied at the rate of 4 kg. per cu. m.

FERGUSON (W.). **Boron deficiency in Cauliflower.**—*Sci. Agric.*, xviii, 7, pp. 388–391, 2 figs., 1938.

When Early Snowball cauliflowers were grown in nutrient solutions containing 0 to 2 parts per million of boron, the plants not receiving boron became markedly affected as soon as the curd appeared, the smaller leaves round the curd being deformed, twisted, and stunted, and the curd itself remaining almost in a vestigial condition and showing a brown discoloration spreading from the top into the flesh and stalk [*R.A.M.*, xvi, p. 722]. The plants receiving even the smallest amount of boron (0·25 p.p.m.) grew normally. It is concluded that boron applications to the soil may prevent the browning of cauliflower curds prevalent in Eastern Ontario in 1937.

SKUDERNA (A. W.). **Treatment of Sugar Beet seed.**—Abs. in *Facts ab. Sug.*, xxxiii, 4, p. 38, 1938.

Previous experiments (from 1919 to 1928) on the formaldehyde gas treatment of beet seed generally resulted in some increase of acreage sugar yields. Of late years Minnesota farmers have been treating their seed with ceresan dust (4 oz. per 20 lb.), usually a satisfactory method [? of combating such organisms as *Phoma betae*, *Pythium de Baryanum*, and *Corticium solani*: *R.A.M.*, xvii, p. 90]. In 1937 the following dusts were experimentally tested at Rocky Ford, Colorado: 1937 'Ideal', a 1:1:1 mixture of copper carbonate, mercuric chloride, and urea, ground to a fine powder, at the rate of 4 oz. per 15 lb. seed; copper carbonate, same rate; ceresan, same rate: and a mixture of ceresan and copper carbonate (2:1) 3 oz. per 15 lb. While all the treatments increased the yield, the difference was particularly suggestive in the case of ceresan, the production of the plants from seed disinfected with this substance amounting to 16·83 tons of beets and 6,610 lb. sugar per acre compared with 15·28 and 6,087, respectively, for the untreated controls.

CLEARE (L. D.). **Plant legislation in British Guiana and the Caribbean colonies.**—*Agric. J. Brit. Guiana*, ix, 1, pp. 25–38, 1938.

The legislation affecting the import and export of plants and plant products, including fruit and vegetables, at present in force in British Guiana and the British West Indies is summarized in tabular form, so that the restrictions in force with respect to any particular product in the area can easily be ascertained.